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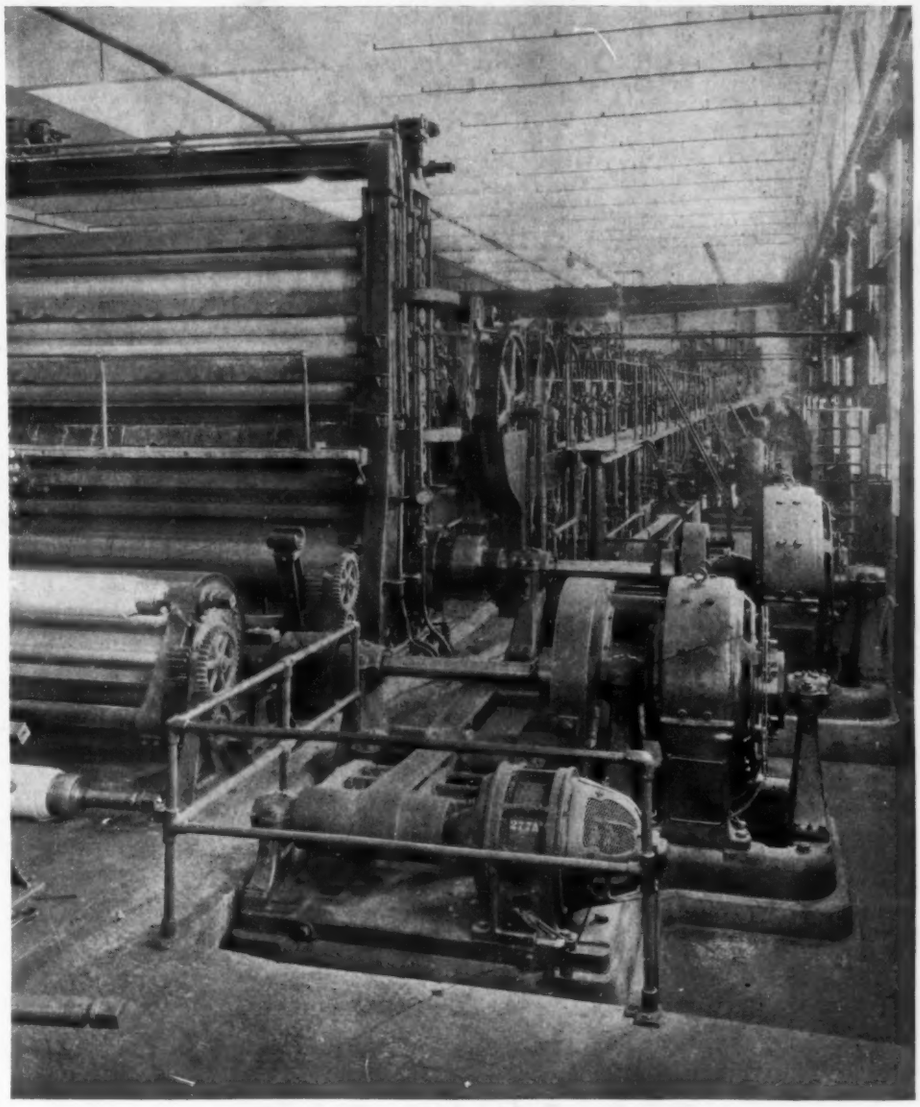

A New All-Electric Paper Mill

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Alternating Current Substation Design in Philadelphia
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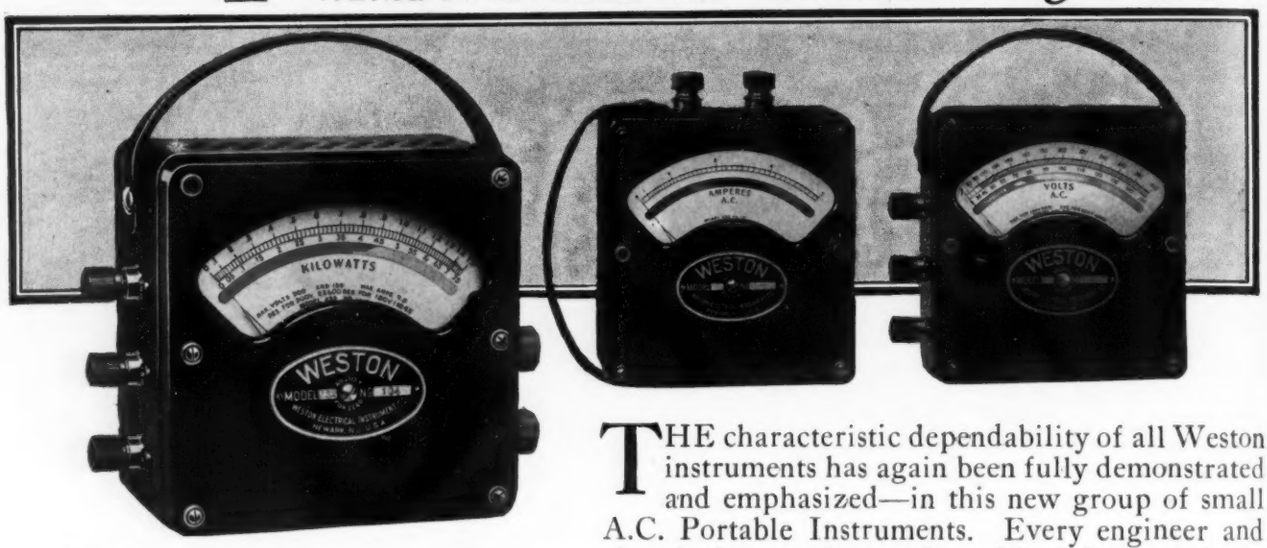

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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The More Vital Credit

EVER since men turned from warfare as a normal occupation and became engrossed in industry and business, credit has been enthroned on high. Security, opportunity and prosperity have been maintained not by the sword, but by the greater resources of peace—service, fair dealing, responsibility, capital. And out of capital and character men have also built credit — which brings the privilege of calling to their needs the capital of others, lodged in the bank as a common fund for the use of industry.

And so the executive of every public utility, of every manufacturing enterprise and of every jobbing, contracting or retail merchandising or other business strives to establish credit at the bank. He realizes that the good will and confidence of the bank are greater assets to him than all his money on deposit. He knows that with the bank behind him he can expand and grow and meet his troubles when they come. But he forgets sometimes that *it is even more important to cultivate credit with the public than with the bank.*

CUSTOMER ownership of securities is a demonstration of the awakening of business men to the significance of this great truth. Public utilities are selling their stock to their consumers that people may become interested in utility problems and concerned with the prosperity of the public service corporations of their communities. Manufacturing companies are assisting their employees to purchase shares that self-interest may develop loyalty and promote thrift among them. Men are suggesting that the tribulations of the railroads could be ended by the sale of their securities to their employees and to the shippers and passengers whom they serve. It is dawning upon our minds that the public has an interest in and an influence upon the affairs of all individuals and all business enterprises.

Public sympathy with its purposes, public approval of its methods, public confidence in its product, public respect for the character of its personnel, public good will toward its activities, public pride in its success — these are great resources for any business. In short, this intangible but very present thing that can best be called *credit with the public* is an asset as valuable as, even more valuable than, credit at the bank.

THERE is a great thought in this that should be pondered well by the executive of every central station and every other electrical business. It should be well taught to all employees. It should be a guiding principle in all their work, clearly expressed in their relations with their customers.

For the entire electrical industry is virtually founded upon our great utility services, publicly regulated and more and more publicly owned. Credit with this public is therefore absolutely vital.

Thomas Addison

An inspiring example to all electrical men and an executive who has built up the electrical industry in the West.

SIX years after the Thomson-Houston Company had in 1884 made a spectacular start on the Pacific Coast by installing an incandescent lighting system at Sacramento Dr. Thomas Addison of Chicago came to take charge of the Western branch of the company. The first electric railway of California was under construction at San José at the time, and the first duty of Dr. Addison—who had entered the new electrical field after eight years of practice as a graduated physician—was to oversee the installation of Thomson-Houston equipment. From that time on his story may be said to be the story of the growth of a great company. Its Western branch passed through the phases of amalgamation with the Edison General Electric Company and its change to its present form under his direction. From being an organization confined mainly to the handling of generating equipment, it expanded into the field of motors and became a factor in the growth of irrigation as a power-company load, making its contribution as well to the rapid industrial development of the Coast.

Dr. Addison, who was born in Courtland, Mich., was graduated from Bellevue Medical College with the class of 1877. In 1885 he forsook his profession to take employment with the United States Electric Company of Chicago, and in 1888 he accepted a position as apparatus salesman with the Thomson-Houston Company at that city. When the Western branch of the company was reorganized in 1890 he was selected to go to San Francisco as local manager. Two years later he became Pacific Coast manager of the General Electric Company, and this post he has filled for more than thirty years.

Dr. Addison's great contribution to electrical progress has not been confined to the advancement of his own company. He has taken an active part in the upbuilding of other branches of the industry besides his own and has shown a warm interest in the formation of local technical and commercial organizations and their development to their present importance. His sympathetic encouragement has been an active factor in the cultivation of such new fields as electric pumping in irrigation or, more recently, the advance of electricity into the oil fields.

For twenty years he acted as chairman of the board of trustees of the State Normal School of San José, and at one time he was a director of the Berkeley National Bank. He is a man of wide interests and a member of many associations and clubs. "The Doctor," as he is affectionately called, is often termed the father of the industry in the West.

Editorial Comment

Electrical World, March 3, 1923

Volume 81 Number 9

Load Factor Versus Diversity Factor

IN HUNTING for load-factor business the tendency too frequently is to bait the hook with a ridiculously low energy rate. This policy is short-sighted, especially in the case of steam-operated systems, because load factor is desirable at all times provided it is obtained from system diversity factor. Diversity factor forms the cornerstone of the electric light and power business. Typical examples of two systems, each fitted for the particular kind of load it carries and neither of them capable of carrying the load of the other profitably, will suffice to illustrate the point.

The system of the Niagara Falls Power Company is the finest example of hydro-electric development in the country. That is to say, it has abundant water, needs no steam reserves and consequently operates at low cost. The yearly load factor of the system approaches 100 per cent. During 1922 the company generated considerably more than two billion kilowatt-hours, and its gross income was more than six million dollars. It does a load-factor business. The Commonwealth Edison Company, on the other hand, furnishes an excellent example of an efficient steam-driven system. Its output, while not quite so large as that of the Niagara Falls Power Company, nevertheless was more than two billion kilowatt-hours last year. From the sale of this energy its income was approximately forty million dollars gross. Of course, it costs more to generate electricity at Chicago than it does at Niagara Falls; but that is not the point we wish to make. We merely compare a typical and excellent load-factor system with a typical and excellent diversity-factor system. The Hydro-Electric Power Commission of Ontario furnishes another example. Although the provincial commission buys power at, say, $30, the local Hydro systems sell for, say, $20. In the first case twenty-four-hour power is involved (load factor), whereas the local community sells eight-hour power two or three times over (diversity factor).

Make Your Business Office Conspicuous

WHY is it that many central-station companies make their business offices and display rooms so inconspicuous? In some cases it seems as if an actual attempt is made to keep these places hidden. Recently a man who had business with a central-station company in a city in which there is competition with a municipal plant inquired at a retail electrical merchandising store as to the location of the office of the private company and received directions which led him to the municipal-plant office. It was here that the location of the office of the private company was ascertained. The first direction might have been a result of misunderstanding; but inquiries from a traffic policeman and from several persons in small stores using electric light revealed ignorance or brought directions to the municipal office.

After a half hour of wandering, the building, in which there are two utility business offices, was found. Its front was dominated by a flaming electric sign belonging to a totally unrelated business. From across the street it was almost impossible to read the small window signs on each utility office window, and it would have been easy to pass both offices on the same side of the street without seeing them. Both, however, were attractively arranged, and the reception of the inquirer was courteous and all that could be asked.

In noticeable contrast with these inconspicuous quarters numerous signs, electric and otherwise, advertising other businesses could be seen in every direction from the entrance to the building. Despite the fact that the municipal office was in an out-of-the-way place, it had an electric sign that could not be missed, and at another point in a conspicuous location was an enormous electric sign advertising the municipal-plant service.

Except that there is competition in this particular instance, the situation can be duplicated in altogether too many other places. Such central stations seem to be like the physician who will not take his own medicine or the cobbler who cannot provide his own family with shoes. There is something fundamentally wrong with business policies of this sort. The business office of the utility ought to be at least as conspicuous as any business enterprise in town.

An Electrical Giant Makes Its Bow to Industry

PLATO said that society arises because different men are better skilled to supply different wants and thus the wants of each are supplied by mutual arrangement and division of labor. It might well be said today that industry progresses because electricity becomes more and more applicable to the supply of its needs and permits it to conform more nearly to the statement of Adam Smith that division of labor is the chief cause of improvement in its productiveness.

With untiring persistency, electricity is invading every industry and, through its flexibility, ease of control, safety and adaptability to every need of the industrial process, is eliminating waste, increasing production, bettering working conditions and changing production methods. This unceasing invasion is unprecedented in industrial history and yet is so universal and so gradual that it is difficult to record decisive victories in its progress. What is required is a record of the state of electrification in the different industries at intervals which afford data for making comparisons over a period of time.

In this issue of the ELECTRICAL WORLD a very complete, new all-electric paper mill is described, with detail

tabulations of all the electrical equipment and with statements of the engineering reasons for its selection and installation. The magnitude of the project, with its 65,000 hp. in motors, necessitated the use of a greater number of pages than are usually devoted to one article, but the fascinating story of paper making, in the opinion of the editors, makes the article unusually interesting. The recording of the electrical statistics of this great paper mill should serve a good purpose. The story is typical of the electrification existing or coming into being in many other industries.

In its engineering features the paper mill is most interesting from the control standpoint. The paper machine presents a control problem for engineers whereby precise adjustments of speed over a wide range of speeds are required on a group of direct-current motors operating on the same machine but without mechanical connection. Faced with this problem, the engineers of the several manufacturing companies obtained solutions which have all been applied with success. An incidental outcome lies in the fact that the same type of control has been found applicable in several other industries.

In its other engineering features the paper mill is chiefly of interest because of the magnitude and number of the motors required and because the power factor of the complete installation is so well controlled by the battery of large synchronous motors. This installation should surely pave the way for similar paper mills in localities where hydro-electric power and forests are found and can be put to good use. In many localities similar to Three Rivers water powers are wasting their energy because they are distant from settled communities, and these should be used to serve industries—for example, the paper industry—until settlement and progress provide other loads.

Codes of Ethics Are Aids to Higher Professional Standards

THE engineer has long prided himself on his professional standards and has jealously built and guarded his reputation for fair dealing on a plane of high integrity, honor and ethics. On the whole, however, he has been unduly reticent in telling his fellowmen about his ideals and aspirations, his qualifications and characteristics. Men in other lines of professional and business life have recently been active in telling the public how good they are—at least, they have been organizing and "cleaning house" and otherwise arranging affairs to show the people that the conduct of their business is above public or private reproach. As a matter of fact, the art of being good had so far progressed that the American Academy of Political and Social Science was able about a year ago to collect "codes of ethics" from every calling on earth—except the ministry!

However, the issuing this week of a reprint of the "Code of Principles of Professional Conduct" adopted by the American Institute of Electrical Engineers in 1912 calls to mind that, although the engineer has been somewhat quiet about this work, he has been effectively at it for over a decade. The civil engineers adopted a code in 1914 and the mechanical engineers in 1922; the mining engineers still say that the Bible is good enough for them! It should be a point of pride with the electrical engineers that their code was the predecessor—and has served as a pattern—of the other engineering codes. The original impetus was President S. S. Wheeler's address on "Engineering Honor" in 1906, after which committees began to formulate the code as it now stands.

Among professional societies in particular these codes of honor have become important factors in upholding high ideals in the constantly broadening relations of the various groups. The simple statement of desirable professional procedure and attitude has been very helpful, particularly to the younger members of the professions. The American Institute of Electrical Engineers, when the subject was raised again last year, gave evidence of its satisfaction by reaffirming its 1912 code, saying that it "had served its purpose effectively during the past ten years," and by directing its code committee to examine into practices of members which may be regarded as prejudicial to the welfare of the Institute. That the committee has done this effectively in two or three instances is sufficient proof of the desirability and appropriateness of the code.

Automatic Equipment Does Not Replace Human Intelligence

OCCASIONALLY an engineer or operator with experience that seems to back his opinion rises to declare that some type of automatic installation is going completely to displace the human element in a particular field of electric plant operation. Such declarations, for instance, have been heard about the automatic substation. An examination of the facts usually discloses that a successful installation has been made under a certain set of conditions and does almost all that the enthusiastic individual claims for it, incidentally showing the existence of a broad field of application for its use; but this field comes far short of comprehending the entire range of conditions met with in plant operations of the general character under discussion.

An examination of the application of automatic equipment in the industrial field discloses many types that seem almost to do their own thinking, so marvelous are the results. Such equipment, however, is designed to go through a given cycle of operations. If that cycle does not occur, the machine ceases to function and human hands must be ready to take hold and start the operation anew. Automatic equipment of any type in an industrial establishment merely performs mechanical operations and increases the amount of work that one human being can do by freeing him of things that require no intelligence to perform or that can be reduced to a pure mechanical cycle. This principle is true in the application of automatic devices in the substation or generating plant.

In a recent discussion that finally led to the question of automatic operation in the generating room a prominent engineer said that he expected in the future to see many operations now manual carried on automatically. He mentioned the synchronizing of machines as an example of the type of operation that can be reduced to a mechanical cycle. This, in his belief, will eventually eliminate the human factor from performance of a kind where mental aberration or accident to the operator may prove serious and allow the attendant to look after routine operation as well as the abnormal occurrences which require human intelligence to correct. The idea back of this expression of opinion was that the constantly increasing concentration of power in huge plant units is such that the operator must be relieved of every manual operation possible and left to see that

apparatus is functioning properly. There are more operations to be performed than the human brain can be safely burdened with, and mechanical or electrical devices must be used to increase its power of accomplishment by confining its activities to the operations that actually need thinking power. This is the principle from which the design and installation of automatic plant equipment should be viewed. Its application will many times produce a part of the plant which will not require the physical presence of a human workman for long periods of time. In many other cases it will merely supplement human efforts. It will never completely replace human intelligence.

Advocates of Superpower Systems Have Lesson to Learn from South

IN MOST discussions of proposed superpower systems the greatest obstacle to accomplishment seems to center around the financing of such a system, the contractual relations and the supervision of operating procedure. The delay seems to be due not so much to technical difficulties as to the inability of the companies concerned to agree on arrangements that will be mutually satisfactory. On these phases of the subject the central-station companies in the Southeastern part of the country have taken the lead.

When the growth of industry and demand for power in this section began to exceed the electric service facilities which each individual company could provide separately, the executives got together. Despite the fact that the extreme tips of the system to be interconnected were more than 900 miles apart, there was no talk of 220-kv. transmission lines, and there still seems to be no need of them. Physically, about the only thing that had to be done was to extend and reinforce certain lines strategically situated between systems and provide sufficient transformer and switch capacity to handle exchange energy. Contractually, it was found necessary merely to agree upon a common frequency, a fixed rate for hydro-electric energy, a sliding-scale rate for steam power, the charge for transferring energy over any system to an adjacent one, and the necessity of one load dispatcher having supervision over all the interconnected systems so far as interchange is concerned. Aside from these preliminaries there were practically no other agreements except a gentlemen's understanding that if one company needs energy and another can furnish it there will be an interchange of power.

No supervoltage lines were required because in transferring power from one extreme side of the system to the other the energy is relayed. For example, if the Yadkin River Power Company desires power, the Alabama Power Company may deliver it to the Georgia Railway & Power Company's system, which will utilize it in the portion of its system nearest Alabama. In turn it will deliver energy from that portion of its system nearest the Carolinas to the Southern Power Company, which will relay the energy in the same manner to the ultimate user. To allow for line loss, each company requires that a fixed percentage over the power to be transferred be delivered to it.

In building the lines to interconnect the adjoining systems there was no quibbling over who should pay for them. Each company paid for the portion of the line within its own state or recognized service district, realizing that it would benefit as much by the interconnection as the adjacent system and also that the line might open up new markets for power.

Rates for power are plain kilowatt-hour rates without complications such as power factor, load factor or demand clauses. The wattless load is distributed by the central-system load dispatcher by asking one company or another to raise or lower its voltage.

In other words, every one entering the superpower system recognized that he would benefit by receiving power when sorely needed or by selling surplus power, and that hence some inconveniences or apparent inequitable division of expense would have to be accepted.

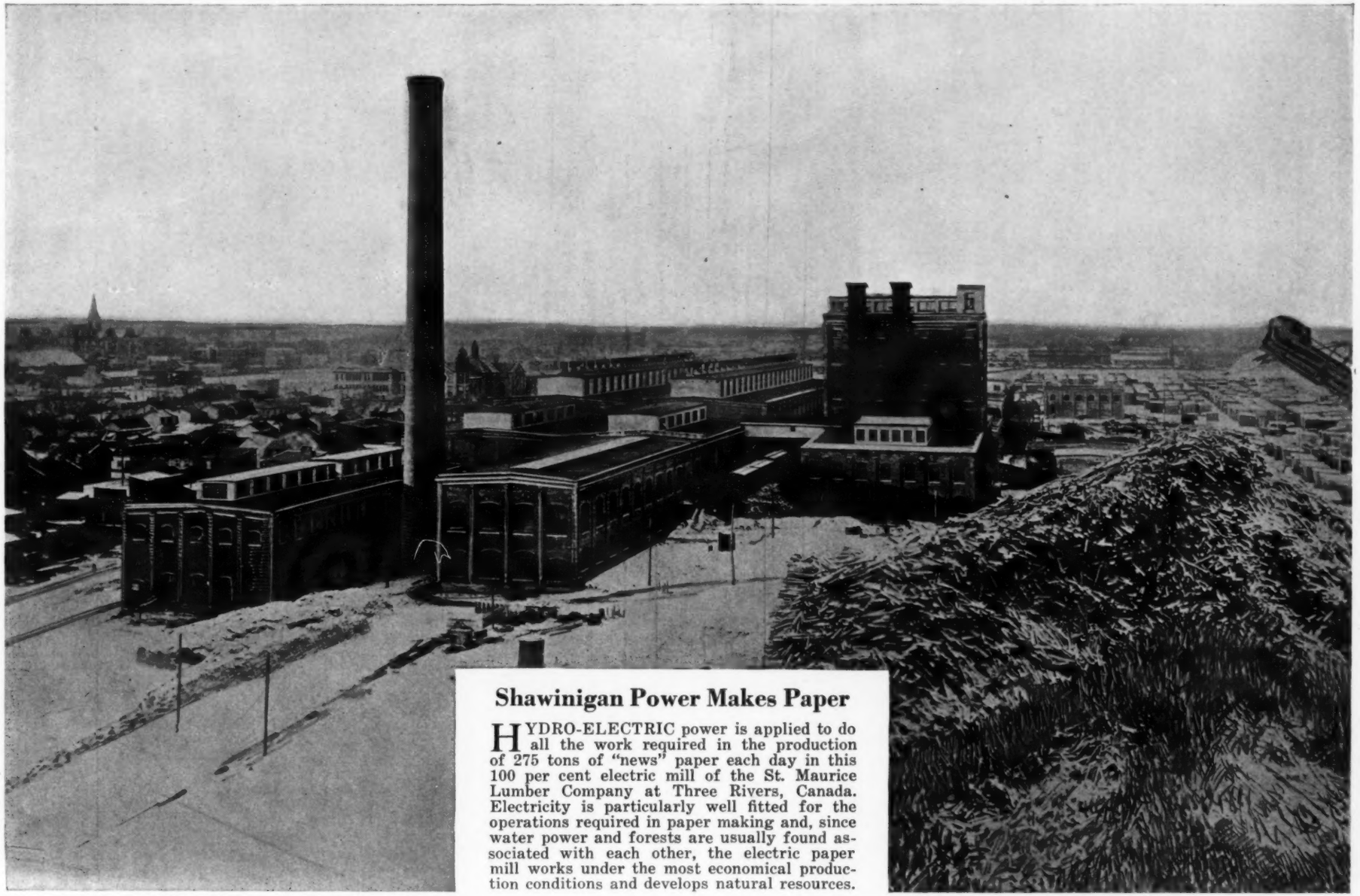
The best proof that these arrangements are agreeable to all is that the Southern superpower system has been operating as such for several years and is still in active existence and that no marked changes have been made in the agreements. The companies admit that improvements can be made, such as still further to reinforce some tie lines and tie transformers or circuit breakers to permit greater exchange of energy without unstabilizing synchronous operation, to make additions or changes which will prevent excessive fluctuations in frequency, to improve relay protection, and so forth. However, all these problems are being attacked already. The unanimous conclusion of the companies is that they are more than satisfied with their superpower system and the method of operation.

The experience and practice of this Southern group of companies should serve as an example to other sections of the country and should also make a worth-while study for politicians who are ranting about adequate utilization of water power for the benefit of the people.

Carrying the Annual Meeting to All the People

THE broadcasting by radio of the proceedings of the annual stockholders' meeting of the Commonwealth Edison Company last Monday was an interesting and significant innovation in utility public relations. About fifteen hundred stockholders attended the second annual meeting at which provision had been made for a large popular attendance. But, since there are now 28,499 shareholders, this left 27,000 persons who for various reasons were not actually present, although no less concerned. There are, besides, the 610,000 customers of the company who are interested in both the welfare and the activity of this public service corporation. Normally, many of both groups would gain some knowledge of the meeting from the report in the morning papers, but in addition, this time, radio was utilized to bring practically into the audience all those who cared to "listen in" to what was being said and done by the gathering in "Customers' Hall."

It was, of course, a gesture, but it means much. The broadcasting of President Samuel Insull's address, of recommendations from the board of directors for the authorization of a twenty-million-dollar increase in capital stock and of the action of the meeting in indorsing this recommendation was the acknowledgment by the utility not alone of the right of shareholders to be informed and to participate but of the interest and concern of the general public also. It was a graceful and deliberate expression by one of the most important central-station companies of its responsibility to all of its stockholders and to all the people.



Shawinigan Power Makes Paper

HYDRO-ELECTRIC power is applied to do all the work required in the production of 275 tons of "news" paper each day in this 100 per cent electric mill of the St. Maurice Lumber Company at Three Rivers, Canada. Electricity is particularly well fitted for the operations required in paper making and, since water power and forests are usually found associated with each other, the electric paper mill works under the most economical production conditions and develops natural resources.

A New All-Electric Paper Mill

By A. H. WHITE* and
R. H. ROGERS†

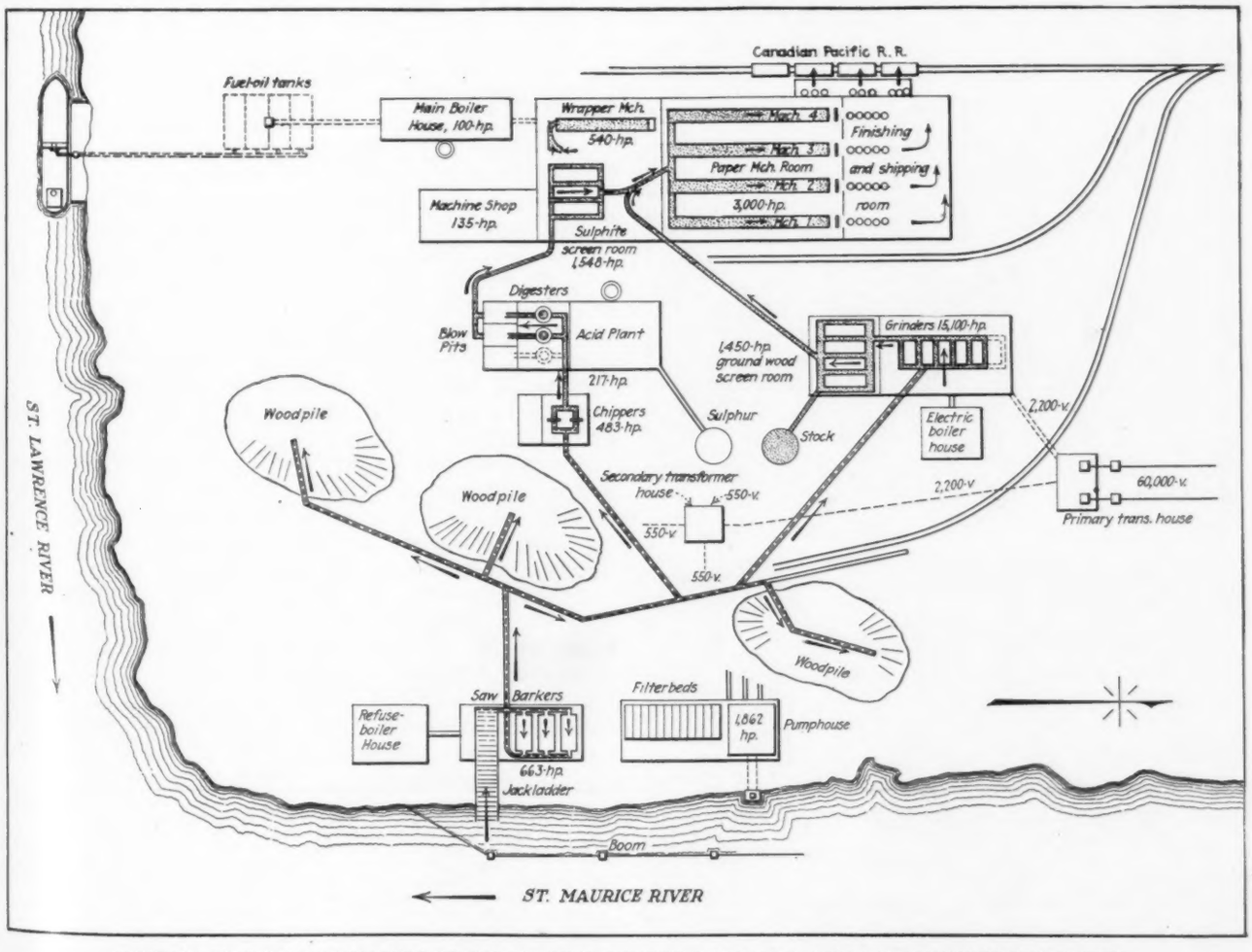
Process Requirements Governing the Selection of Motor, Control and Electrical Equipment for the Electrification of Paper Mills—Installation Details for 65,000-Hp. Motor Drives and Description of Electrical Material-Handling Equipment Required in the Production of Paper

SAMUEL DE CHAMPLAIN, as he was exploring from Quebec toward the Great Lakes, discovered a broad river coming into the St. Lawrence from the north, divided at its mouth into three channels by two islands. He founded a settlement here in 1634 and called it Trois Rivières, the Three Rivers of English-speaking people. That it is a strategic point for the production of pulp and paper is proved by the number of successful mills in the vicinity and the rapid, healthy growth of the city since their coming. The St. Maurice River, clear and broad, taps the great forests of the north and furnishes the vehicle that brings the logs to the saws. Its energy, converted at Shawinigan Falls and Grand Mère, not far from its confluence with the St. Lawrence, furnishes 275,000 kw. of hydro-electric power to neighboring industries. The clearness of its water materially aids in the production of a "bright sheet," and steam boilers fed from the St. Maurice show the sustained efficiency that can come only from an ideal feed water.

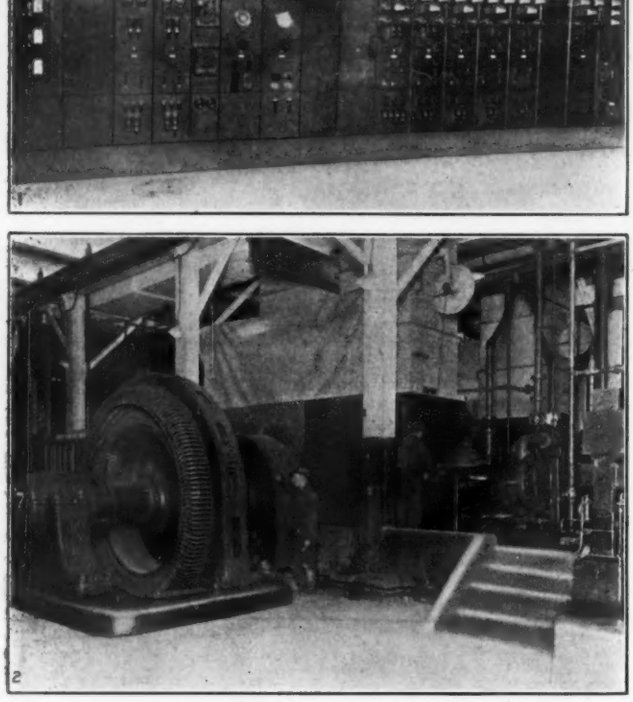
The transportation facilities here, midway between Montreal and Quebec, are excellent. The St. Lawrence furnishes a water route for incoming pulp wood and for finished paper to Great Lakes ports, Atlantic Coast and European cities during seven months of the year. Fuel-oil tankers steam up from the sea to dock and discharge to mill storage tanks. The canal route via Lake Champlain furnishes a much-used outlet directly to New York City. The Canadian Pacific Railroad with ample sidings keeps the local industries in touch with the whole continent.

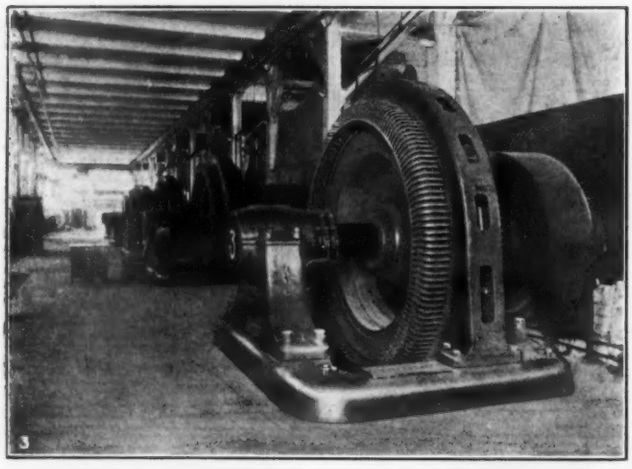
In such a setting is the newest mill of the International Paper Company, known as the St. Maurice Lumber Company paper mill. It is the business of this

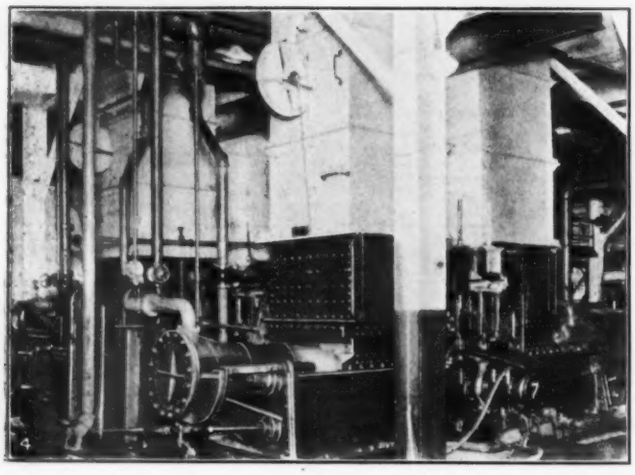
*Chief engineer the International Paper Company.
†Power and Mining Department, General Electric Company.



GENERAL LAYOUT OF PAPER MILL PLANT SHOWING BUILDINGS AND RAIL AND WATER SHIPPING FACILITIES





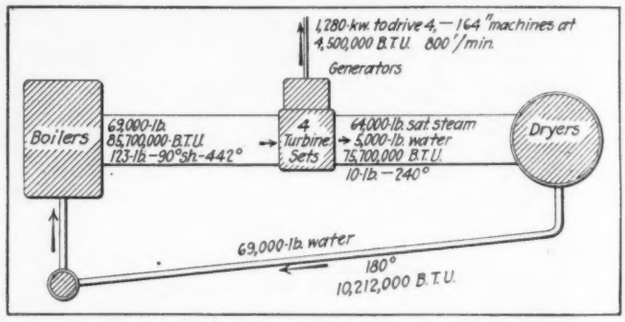


plant to produce news paper composed of about 75 per cent mechanical (ground-wood) pulp and 25 per cent chemical (sulphite) pulp, made from logs that average about 60 per cent spruce and 40 per cent balsam.

The four 164-in. paper machines, to which the whole organization and structure are subservient, were put in production in the past summer—the last one in August. They are already making over 275 tons of "news" per day, and their ultimate capacity, after the installation of the seventh grinder unit and the third digester, will be more than 300 tons per day. The present daily production represents more than 1,200 acres of paper, or a sheet 12½ ft. wide and 875 miles long, turned out at the rate of over 36 miles per hour.

One ton of "news" as now being produced at this mill (based on one month's figures) requires a little over a cord of wood, 1,347 kw.-hr. of hydro-electric power, 7.21 tons of steam produced by 3⅛ barrels of fuel oil for mill heating, pulp cooking, paper drying and for direct-current electric power for driving the paper machines; fifteen man-hours of labor and supervision, and five and a quarter minutes for production.

The logs, 13 ft. to 16 ft. in length, are sawed and barked during the summer months, and the surplus



HOW THE HEAT IS DISTRIBUTED IN THE STEAM CYCLE USED IN THE MILL

over current demand up to 66,000 cords can be stored for winter. The four fuel-oil tanks hold 150,000 barrels, or more than six months' supply of Mexican residue. Two transmission lines and transformer banks can furnish 24,000 kw. of hydro-electric power. The pump and filter plant has a capacity of 20,000,000 gal. of filtered water per day. The main boiler house can turn out more than 6,000 boiler-horsepower continuously.

The outstanding feature of this mill is the extent to which electric power is used, together with the novelty of many of its specific applications. Every application of power is electric, and it is the only 100 per cent electric paper mill in the industry.

Two 60,000-volt, 60-cycle, three-phase transmission lines come from the north to the main transformer house at the northern limits of the mill yard. Six single-pole, 600-amp., 110,000-volt disconnecting switches lead to the two three-phase, four-tank, 60,500/72,500-volt lightning arresters, which are of the electrolytic outdoor type. Six 600-amp. cylindrical suspension

Synchronous Motors Grind the Wood

No. 1. Main switchboard in ground wood mill controls six synchronous motors aggregating 14,400 hp.

No. 2. Hydraulic rams force the logs against the synchronous motor-driven grinder. At right is automatic motor load regulator which is actuated by hydraulic pressure.

No. 3. Six of the seven 2,200-volt, 2,400-hp. synchronous motors which drive pulp grinders.

No. 4. Every three hours a stone-burring lathe is automatically brought into operation without stopping production. The toothed wheel in the magazine feeding pulp grinders registers the cords of wood fed to machine.

outdoor choke coils are interposed just outside the 100,000-volt wall bushings. After going through two 600-amp., 66,000-volt, triple-pole, single-throw, remote-control oil circuit breakers the voltage is stepped down from 66,000 to 2,300 by means of six 4,000-kw. oil-insulated and water-cooled transformers.

Well protected in a room at the end of the transformer house is the four-panel instrument board, where the incoming power is metered on the 2,300-volt side of the transformers. The instruments installed are watt-hour meters, indicating and curve-drawing wattmeters, indicating voltmeters and ammeters, ground detectors for the cable system and an indicating power-factor meter. On these panels are also mounted all necessary instrument protective devices. The entire equipment of this main transformer house was furnished by the Canadian Westinghouse Company with the exception of the transformers, which were built by the Westinghouse Electric & Manufacturing Company.

A tunnel 150 ft. long takes 2,300-volt power from the main transformer house to the switch house alongside the wood grinder room, where there is a connected load of 15,100 hp., with another 2,400-hp. unit on order. The conductors through the tunnel are eight three-conductor, 1,000,000-circ.mil, 2,300-volt cables.

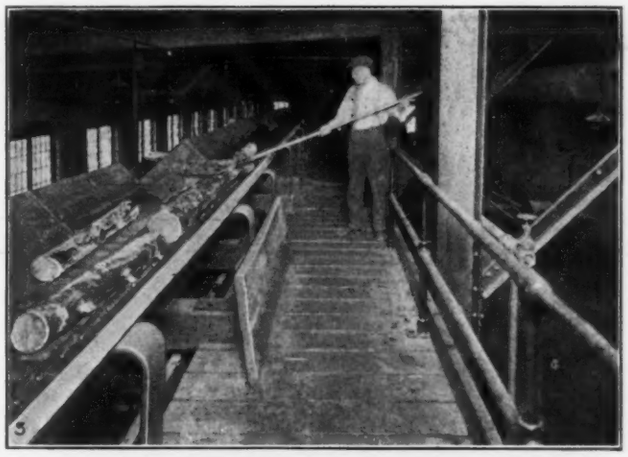
SECONDARY TRANSFORMER HOUSE FOR MILL SUPPLY

There is a secondary transformer house located conveniently for general distribution to the mill and connected to the main transformer house, 960 ft. away, by two sets of twelve 4-in. ducts with manholes about 150 ft. apart. Twelve ducts each contain a three-conductor, 600,000-circ.mil, 2,300-volt cable; five ducts each contain a three-conductor, 300,000-circ.mil, 600-volt cable, and another contains a two-conductor, No. 2/0 cable for 125-volt direct-current switch control.

The secondary transformer house steps the 2,300-volt circuit down to 550 volts for general distribution throughout the mill and yards. There are mounted here twenty-four 1,200-amp., single-pole, single-throw, 2,200-volt disconnecting switches, twelve 4,000-amp. similar switches and two 2,000-amp. automatic solenoid-operated oil circuit breakers. The transformers are four in number, rated at 2,000 kw. and 2,200/600 volts, and are single phase, oil-insulated and water-cooled. The fourth transformer can be phased in with any other two. There is a 10-kw., 550-110/220-volt lighting transformer installed here, as well as a battery-charging set and a storage battery for switch operation.

Protection is provided by twenty-eight 600, 400 and 300 amp., triple-pole, single-throw, oil circuit breakers, very neatly and conveniently connected and mounted. Eighteen switchboard panels carry curve drawing and indicating instruments for metering the power to various mill divisions.

Four principal lines of ducts radiate from this secondary transformer house and branch off as required to serve the widespread areas of motor applications. The aggregate length of 4-in. ducts, including spares,



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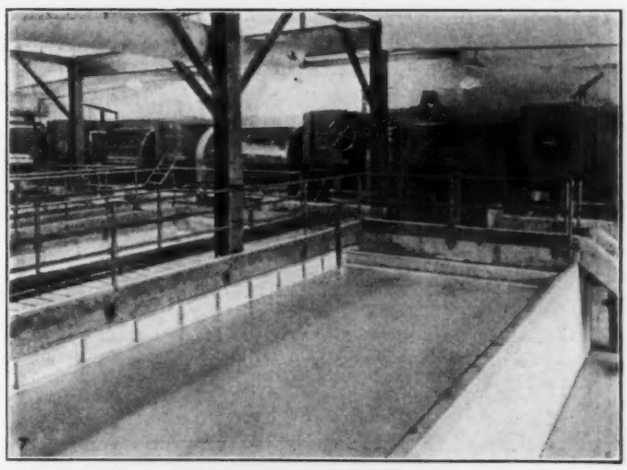

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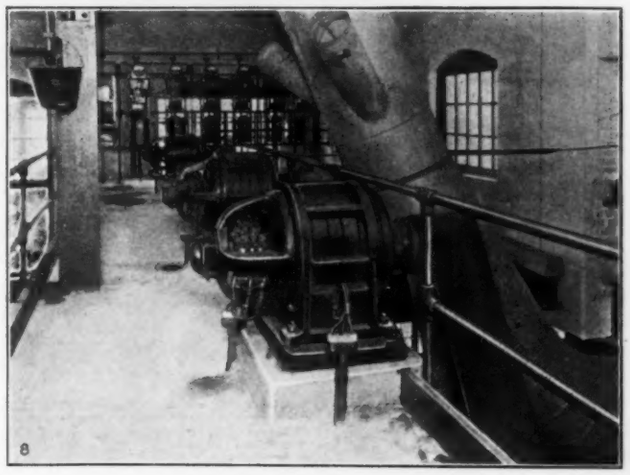


8

Grinding Wood and Cleaning Pulp

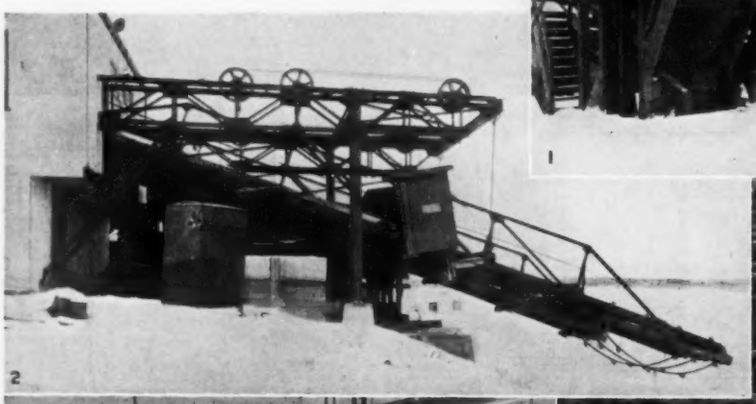
No. 5. One of two 220-ft. conveyors above charging floor in ground wood mill for distributing logs to service piles.

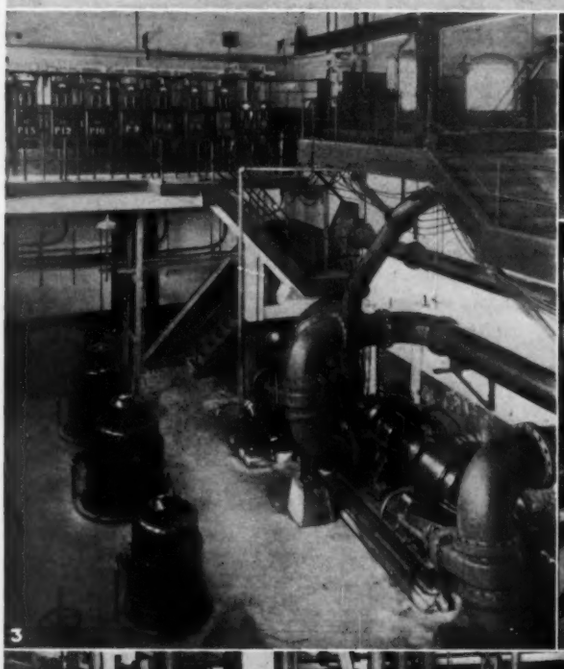
No. 6. From the 200 service piles the logs are placed in the magazine grinders from the charging floor in the ground wood mill.

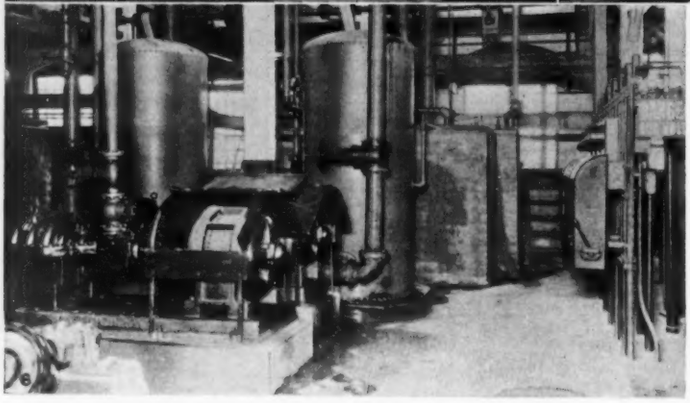
No. 7. In the screen room there are four Sherbrooke revolving screen knotters in the rear of four rifflers each having eleven submerged dams for extracting sand.

No. 8. Six motors of 15 hp. each drive the deckers. Controllers, meters and switches are in the background.

Conveying Equipment for Logs and Water Pumping Station







No. 1. There are over 3,000 ft. of outside conveyors of the cable type. This conveyor comes from the wood preparing plant. In the distance is a stacker.

No. 2. This "Jack Ladder" conveyor handles 16,000 logs per day from the river to the saws.

No. 3. In a pump pit below the river level motor-driven pumps furnish water for the filter plant and mill. The control equipment is located above high water.

No. 4. A portable conveyor driven by a 15-hp. motor reclaims logs from storage and takes them to the permanent conveyor for delivery to chipper and grinder buildings.

No. 5. Group of five deckers chain driven from a line shaft. Six of these groups of pulp thickeners are in the ground wood screen room.

No. 6. One of two pairs of high and low pressure pumps for the grinder hydraulic jacks. Compensators are shown at right.

CHIP SCREENS GRADE THE CHIPS AND RETURN OVERSIZE CHIPS TO THE CHIPPERS

LOGS RECEIVED BY RAIL ARE HANDLED BY A STACKER AND CONVEYOR SYSTEM

installed is 15 miles, with access through about thirty-five manholes.

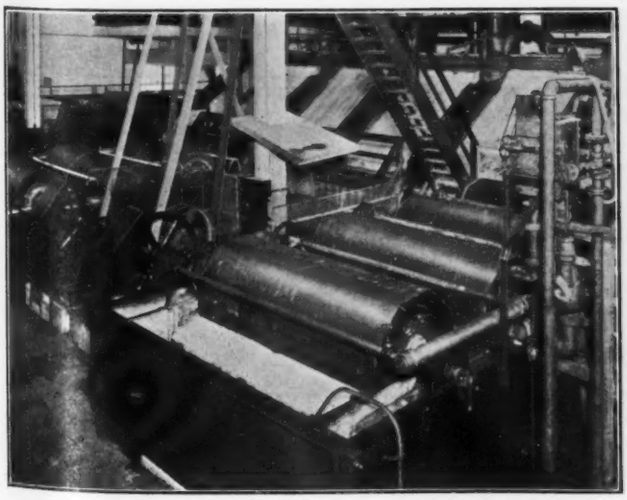
The connected three-phase, sixty-cycle induction motor load totals 34,000 hp. in about 400 motors, practically all controlled by oil switches and compensators or drum controllers so installed that the motor and its connected load is in sight from the control point. An important detail here is that all fuses are eliminated.

Three electric-steam generators are being erected in a separate boiler house close to the 2,300-volt grinder-room switch house. These boilers will have a combined capacity of 1,200 boiler-horsepower and can take 12,000 kw. They will have two functions. They will make available to the mill in the form of steam, at no extra cost other than overhead, the "below-peak" energy that would otherwise be paid for and not used. This procedure, of course, reduces the fuel consumption at the main boiler house to that extent. On Sundays, or at any other time of light steam demand, the 1,200 boiler-horsepower of the electric-steam generators will make it possible to shut down all the oil-fired boilers.

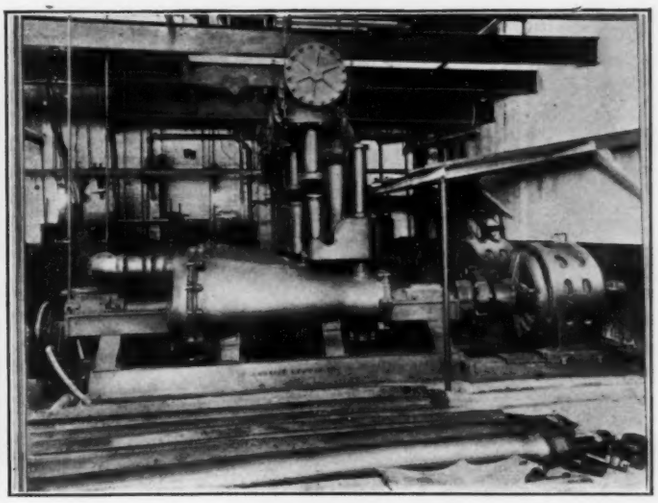
A log boom anchored to piers off shore harbors the logs floated down from the logging camps, and from this inclosure they are hauled sidewise in close formation on a multiple chain conveyor or "jack ladder" to the saws, which can be elevated out of the way of ice during the winter. At the head of the jack ladder they are transferred to another multiple-chain conveyor, which is equipped with jaws that hold securely the individual logs and carry them past the three "slasher" saws that cut them into 4-ft. lengths.

As the 4-ft. logs, end to end, leave the saws, they fall onto a conveyor which takes them endwise to the barking drums, of which there are three. These are huge tumbling barrels having straight-channel iron staves with 2-in. openings between. The drums are mounted horizontally. Both ends are open, and the logs are continually fed into one end and are continually falling over the stationary dam across the other end. The drum is rotated, and at the same time a spray of water is played on the logs. The bark is rubbed, beaten and washed from about 90 per cent of the logs in this process, and those imperfectly barked are returned by a conveyor to the same drums.

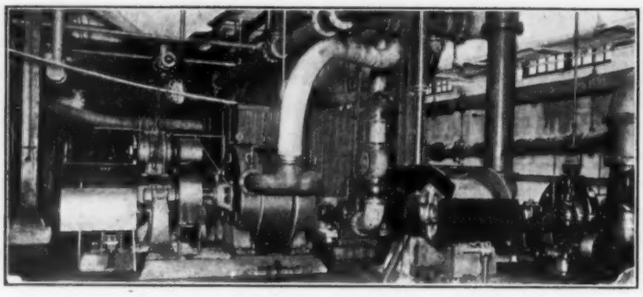
A maximum of 16,000 logs, together measuring more than 50 miles in length, has been drawn from the river, sawed, barked and delivered to the yard conveyors in a day by this wood-preparing plant. The barked logs are then taken in charge by the yard system of cable conveyors, which convey them to the three piles,



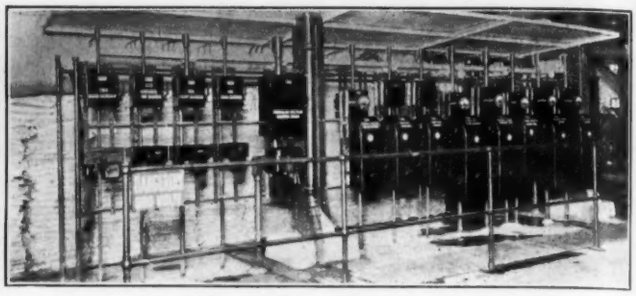
IN THE SULPHITE SCREEN ROOM ARE FIVE INCLINED SCREEN PULP THICKENERS AND TWO WASHERS



AS A RESERVE IN THE SULPHITE SCREEN ROOM ARE FOUR MOTOR-DRIVEN JONES-JORDAN ENGINES



MOTOR-DRIVEN VACUUM AND CENTRIFUGAL PUMPS ARE REQUIRED



COMPENSATORS AND SWITCHES FOR CONTROLLING PAPER MACHINE AUXILIARIES

stack, reclaim and deliver them to the sulphite and ground-wood departments. These cables aggregate 3,000 ft. in length in ten outdoor units.

The motor controllers and protective devices are concentrated in a special control house from which all the conveyor drives can be seen. The control units and instruments are thus protected from vibrations and shocks that they would be subject to if mounted on the conveyor structure.

The barking drums listed in Table I and all the yard conveyor motors in Table II are, it will be noted, of the wound-rotor type on account of the very heavy starting duty with which they are at times confronted. This is especially true of the yard conveyors, which may have to start with a full load of logs or when impeded with snow and ice. Drum controllers are used in the secondary windings with overload oil switches in the primary windings, thus avoiding the use of fuses.

PUMP AND FILTER PLANT FOR WATER SUPPLY

For supplying the enormous amount of water necessary for paper production a pump and filter plant is installed at the river bank. The pump pit contains ten pumps with a combined capacity of 55,800 gal. per minute, or enough to supply a city of 700,000 population. The raw water and fire pumps are below the low-water level of the river. The protective devices, meters and control elements are installed on a gallery overlooking the pit, and they are thus above any danger of flooding. Power is supplied from the secondary transformer house, about 150 ft. away, through three three-conductor, 300,000-circ.mil, 600-volt cables and two three-conductor, 200,000-circ.mil cables. The twenty sand-filter beds occupy an extension, 40 ft. x 180 ft., and they can filter 20,000,000 gal. of river water a day.

The service rendered by this pumping plant is vital, and the pump-pit environment is so exacting from the electrical standpoint that this equipment received the most critical attention in its selection and installation.

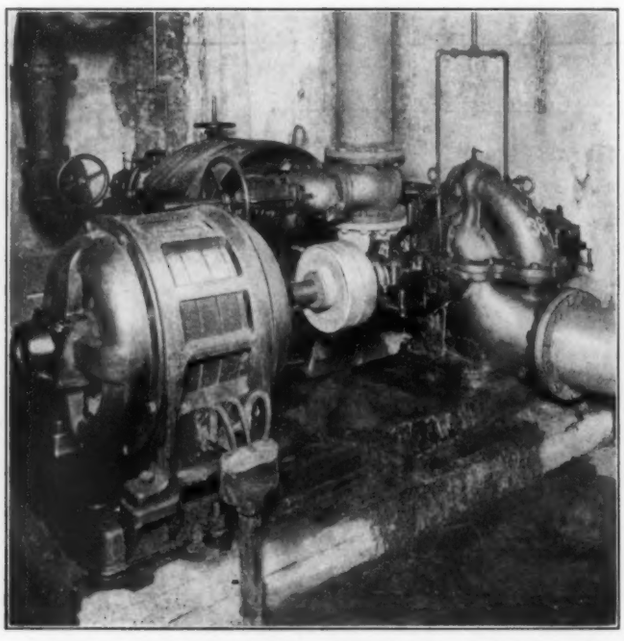
The two electric fire pumps are supplemented by a steam fire pump designed for 1,500 g.p.m. against a head of 280 ft. Wherever it is possible the pumps are so designed and connected that they can pump to the fire mains. Cross-connection with the city provides for mutual protection. The whole rotating weight in the vertical pumps is carried on suspension bearings at

TABLE I—ELECTRIC MOTOR DRIVES IN WOOD-PREPARING PLANT

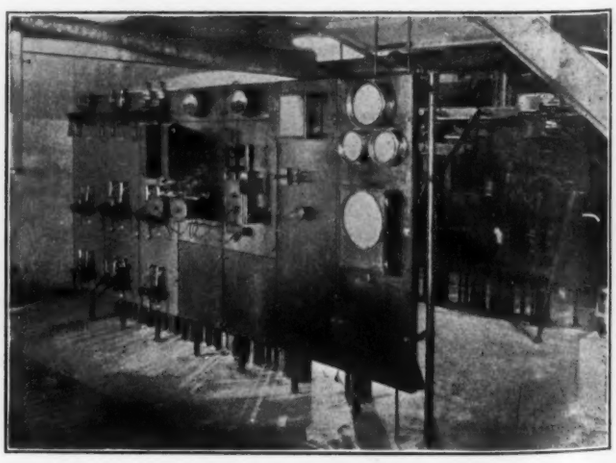
(Total connected load, 663 hp., 550 volts, alternating current.)

Log haul, three saws and knife barker:	
Belts; one 100-hp., 690-r.p.m., squirrel-cage.	C. W.*
Conveyor saws to barker:	
Gears; one 25-hp., 860-r.p.m., wound rotor.	C. W.
Three barking drums:	
Belts and gears; three 150-hp., 690-r.p.m., wound rotor.	C. W.
Conveyor return logs to barkers:	
Gears; one 10-hp., 860-r.p.m., squirrel-cage.	C. W.
Conveyor, wide for bark:	
Gears: one 25-hp., 860-r.p.m., squirrel-cage.	C. W.
Conveyor logs to yard conveyor:	
Gears; one 10-hp., 860-r.p.m., squirrel-cage.	C. W.
Conveyor from knife barker to yard conveyor:	
Gears; one 25-hp., 860-r.p.m., squirrel-cage.	C. W.
Conveyor bark and sawdust to boiler house:	
Gears; one 15-hp., 860 r.p.m., squirrel-cage.	C. W.
Saw sharpener:	
Gears; one 3-hp., 1,800-r.p.m., squirrel-cage.	Cr. Wh.†

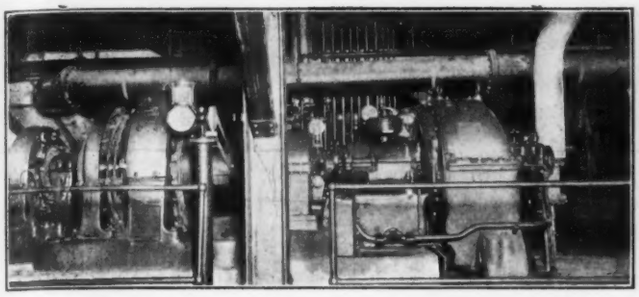
*C. W. indicates Canadian Westinghouse. †Cr. Wh. indicates Crocker-Wheeler.



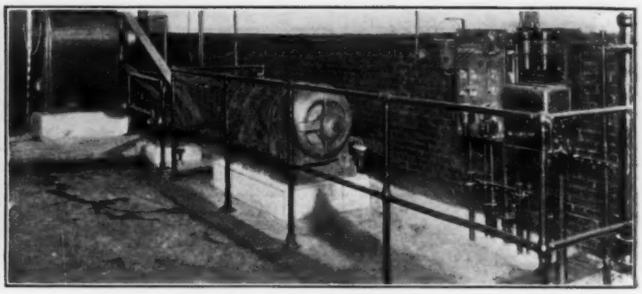
MOTOR-DRIVEN CENTRIFUGAL PUMPS ARE REQUIRED FOR HANDLING WHITE WATER AND STOCK



FRONT AND REAR OF CONTROL PANELS FOR PAPER MACHINE TURBO-GENERATOR SETS



TURBO-GENERATOR SET FOR DRIVING PAPER-MACHINE EXHAUSTS. STEAM PAPER DRYING



MOTOR-GENERATOR SET AND CONTROL UNITS FOR REWINDER MOTOR ON A PAPER MACHINE

the tops of the motors. These bearings have never required adjustment.

The main boiler house lies along the railroad siding between the machine room and the fuel tanks near the southern extremity of the yard. A battery of eight 500-hp. B. & W. water-tube oil-fired boilers extend in a single row down the center with a clear clean space all around them. An inclosure at the north end contains the active electric and the stand-by steam boiler-feed pumps, the fuel-oil pumps and the steam-turbine-driven 180-kw., 550-volt alternating-current emergency generator which is used for lights and machine shops should the hydro-electric power be interrupted.

About 30,000 gal. of fuel oil is being used per day to generate about 5,800 boiler-horsepower from seven boilers at 1.66 load factor. The normal boiler pressure is 125 lb., 95 deg. F. superheat, and the evaporation rate is 14 lb. actual, 15½ lb. equivalent. The draft is 0.1 in. of water, CO_2 content of flue gases 13 per cent, and temperature of the flue gases 550 deg. F. The output of two boilers is required for heating the mill in winter. The feed water is admitted at 205 deg. F. from the dryers without heating and is made up from soft filtered river water.

As before stated, the mill product — "news" — is composed of approximately 25 per cent chemical pulp and 75 per cent mechanical pulp; hence the logs leave the storage pile by two routes to meet finally in the mixing system. The sulphite process produces about 1,200 lb. of air-dry sulphite fiber per cord of wood. It may be noted that being floated down the river, tumbled through the barkers and then onto and out of the storage piles so thoroughly mixes the spruce and balsam logs that there is practically no variation in the quality of product, actual checks at the conveyors over several hours having shown that the proportions vary less than 2 per cent.

In the sulphite process the cleanest logs are selected at transfer points in the conveyor system and sent to the chipper building. Here they may be washed in a drum similar to the drum barkers but shorter; then, if knots or discolored spots remain, such logs receive special treatment on a knife barker.

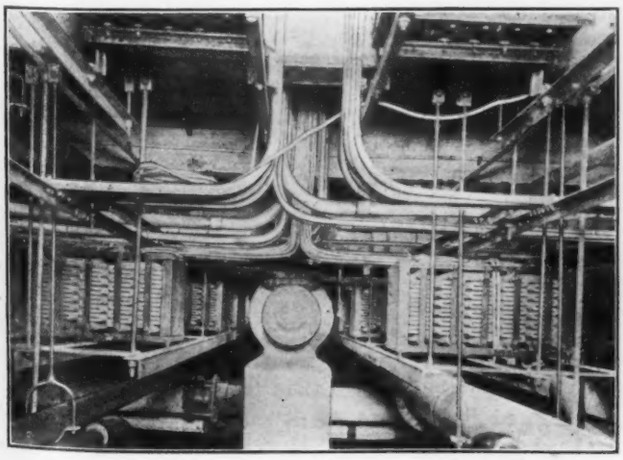
The thoroughly cleaned logs now go to the chippers,

TABLE II—ELECTRIC MOTOR DRIVES ON YARD CONVEYORS

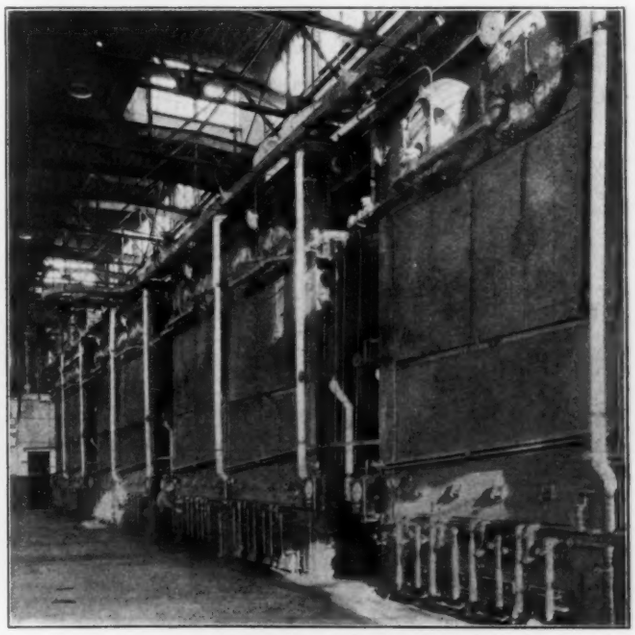
(Total connected load, 360 hp.; 550 volts, alternating current.)

Wood-preparing plant to storage system:	
Gears; one 35-hp., 860-r.p.m., wound rotor.	C. W.*
To south pile:	
Gears; one 25-hp., 860-r.p.m., wound rotor	C. W.
To middle pile:	
Gears; one 25-hp., 860-r.p.m., wound rotor.	C. W.
To north pile:	
Gears; one 50-hp., 860-r.p.m., wound rotor.	C. W.
Along north pile:	
Gears; three 35-hp., 860-r.p.m., wound rotor.	C. W.
Three stackers:	
Gears; three 50-hp., 860-r.p.m., wound rotor.	C. W.
Portable conveyor:	
Gears; one 15-hp., 860-r.p.m., wound rotor.	C. W.
From storage system to chipper building:	
Gears; one 25-hp., 860-r.p.m., wound rotor.	C. W.
From storage system to grinding floor:	
Gears; one 50-hp., 860-r.p.m., wound rotor.	C. W.

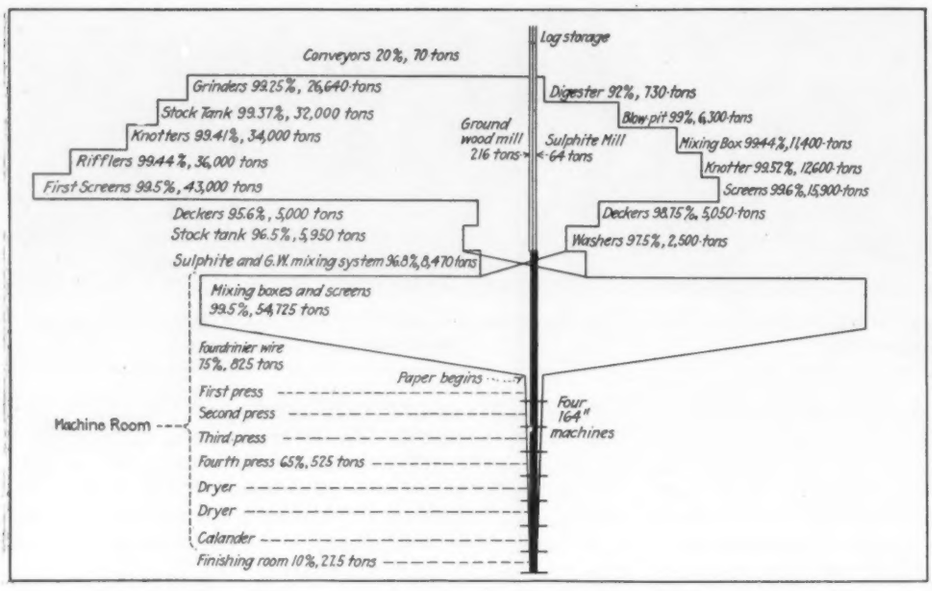
*Canadian Westinghouse.



RESISTORS AND CONDUITS UNDER MACHINE ROOM FLOOR. DRYER JACKETS AT RIGHT AND LEFT



IN THE MAIN BOILER HOUSE ARE EIGHT 500-BOILER-HORSEPOWER OIL-FIRED BOILERS

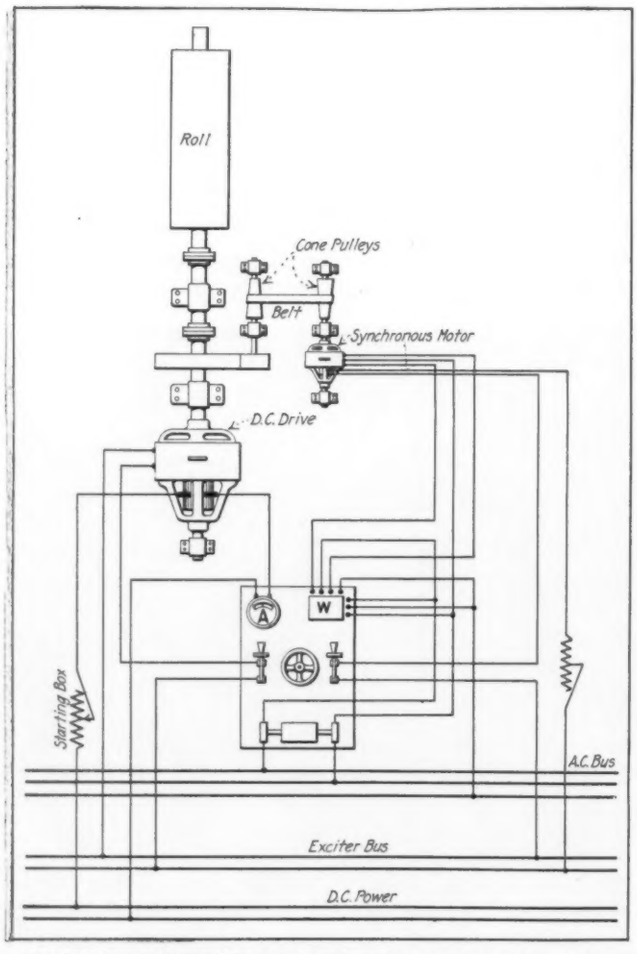


SCHEMATIC OUTLINE OF THE PRODUCTION PROCESS FROM LOGS TO PAPER

of which there are two, each taking its quota. The chipper is a heavy 7-ft. disk carrying three radial blades set as in a plane. The logs by ones, twos or threes, according to size, are fed down a chute at an angle of 45 deg. with the disk, and they are rapidly reduced to chips the size of "small change."

Conveyors take these chips to the tops of large inclined oscillating screens which allow the suitable sizes to fall through onto a conveyor, while the larger pieces slide over a low dam down a chute to the rechipper or "hog" for resizing, whence they return to the screens. Fine particles of the nature of sawdust are blown out and go to the refuse-burning boiler house. The acceptable chips cross over to the digester house on a belt conveyor.

The washing drum and chippers in Table IV are of the wound-rotor type on account of the heavy starting duty. The drum may have to start up with a heavy load of logs in place, and the chippers are characterized by their flywheel effect, which imposes a heavy starting duty.



A SINGLE UNIT SCHEMATIC DIAGRAM FOR SECTIONALIZED DRIVE ON PAPER MACHINE

The chip bin is a huge steel-supported wooden trough just above the digester-charging floor with slide-controlled openings directly over the digesters. By swinging large funnels around on hand cranes, the chips can be discharged into the two digesters, each taking about twenty cords in twenty-five minutes for a feeding.

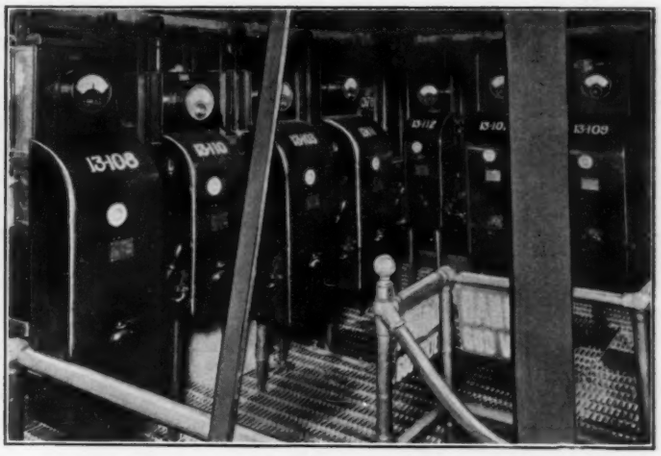
The "acid" building alongside is arranged for preparing and storing quantities of bisulphite of lime. This is made by first melting and then burning sulphur in rotary furnaces and combustion chambers. The resulting sulphur-dioxide gas is water-cooled and forced upward through high towers that are packed with limestone. A supply of water trickles down through the limestone and combines with the gas to form the bisulphite of lime, which is recirculated through the towers before being stored in huge vats.

The digesters are vertical steel tanks with conical top sand bottoms and lined with acid-resisting bricks and mortar. After being filled with chips about 25,000 gal. of bisulphite of lime is pumped in, taking twenty minutes.

Steam is admitted at the bottom, and the pressure gradually mounts to 70 lb., with a resulting temperature of 316 deg. F. The steam flow practically stops after two hours, but the "cook" is continued for over five hours, taking about 250 boiler-horsepower-hours per ton of air-dry pulp. The process of selective digestion lasts about eight hours and is for the specific purpose of digesting the ligneous and resinous binders without harming the cellulose ($C_6H_{10}O_5$) fibers that go into the paper. At the end of the "cook" the contents of the digester are blown into a covered concrete "blow pit," which has a perforated bottom through which the waste liquor drains off to the sewer. The steam and gas fumes pass off through high baffled towers called vomit stacks, which are designed to prevent the escape of pulp. The pulp is now thoroughly washed in the blow pits for several hours until practically nothing remains but the silky unbroken fibers of cellulose.

When the stock leaves the digesters it is 92 per cent water, and it becomes 99 per cent water while being washed in the blow pits. It now goes to a 35,000-gal. stock tank, which stores up enough to convert the intermittent discharges from the digesters into a continuous

EIGHTEEN FLOW METERS ARE ELECTRICALLY RELAYED FROM EIGHTEEN DEPARTMENTS USING STEAM



COMPENSATORS ON GALLERY OVER GROUND-WOOD PUMP PIT TO CONTROL SEVEN PUMPS

process beyond the tank. Horizontal-shaft agitators in this tank keep the contents from settling.

From the tank a steady flow goes through a mixing box, which by the addition of white water from an extracting process further along doubles the volume. A rotary screen of the type called a knotter extracts the coarser clots and fiber bundles, and a still further refinement takes place in the improved rotary meshed-drum "first" screens, which pass only the individual fibers through very narrow slits. The rejected material from the knotters and first screens passes through a "second" screen, which returns the valuable portion to the main stream back of the first screens and sends the coarser parts to the wrapping-paper department.

The stock now cascades down five steep meshed thickeners into tanks in which revolve partly submerged screen thickener drums. The excess water falls through the inclined screens or passes to the inside of the drums, while the pulp adhering to the outside of the drums falls over dams and flows to the soft-stock tank below. The thickeners reduce the water flow from 2,900 g.p.m. to about 400 g.p.m., which leaves the stock about the consistency of thin porridge. The extracted white water goes to a tank, to be worked back into the system in various ways. The screens and thickeners are in a belted group drive with other miscellaneous machinery.

A sulphite soft-stock tank, with a capacity of 45,000 gal., is equipped with a horizontal-shaft agitator to prevent separation. A small addition to this stock comes from two inclined "save-alls" which give the white-water tank overflow a last screening before it goes to the sewer.

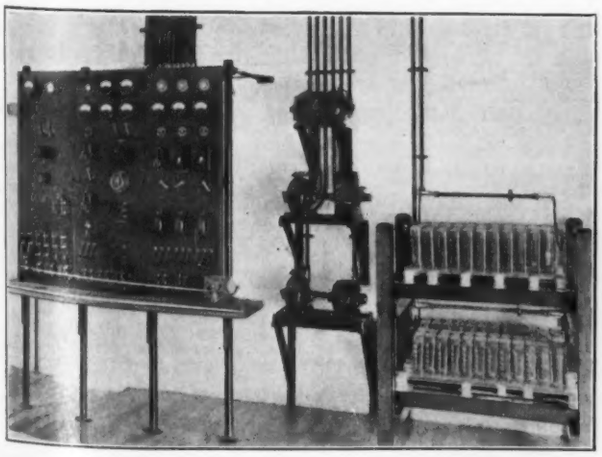
The extreme simplicity of "squirrel-cage" motors make them ideal where the starting duty is comparatively light and where no speed variation is required. They are started with compensators, and in many cases a meter is added to indicate the load. All the motors are protected without the use of fuses.

THE MAKING OF GROUND-WOOD PULP

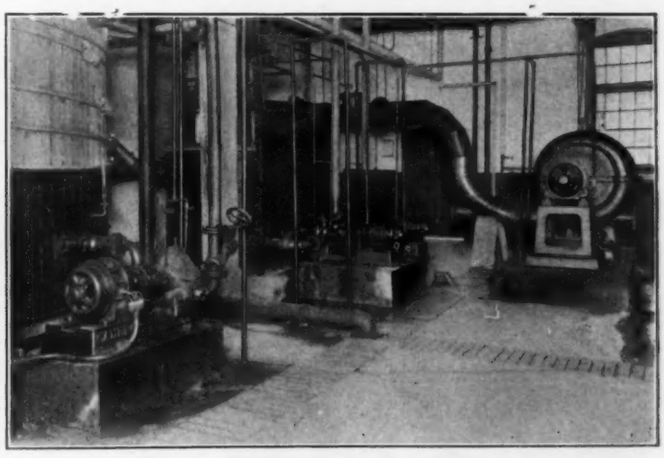
Interest in the ground-wood department centers about the grinders, for here is the heaviest draft on electric power and the greatest material transformation, all carried on with relentless energy and yet with just that skill and delicacy that produce unvaryingly the balance between quality and quantity which goes so far to uphold the mill's production record.

Six General Electric 2,400-hp., 2,200-volt synchronous motors, backed by their switchboards, oil-switch cells, starting compensators and exciter motor-generator sets, form the most imposing array of power in the mill.

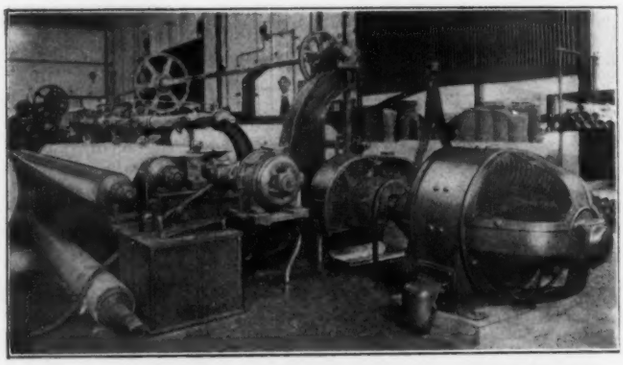
These synchronous motors are designed to allow for a large leading power factor even at fractional loads. As their load far outweighs all the induction motors combined, the power factor for the mill is exceptionally high and is under control through field regulation of the synchronous motors.

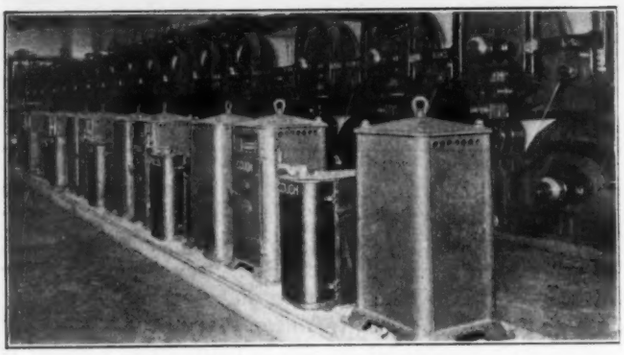


A 25-VOLT STORAGE BATTERY SYSTEM ENERGIZES ABOUT 4,800 CIRCUITS FOR TELEPHONES, FIRE ALARMS, WATCHMEN'S STATIONS, ETC.



AUXILIARIES IN THE SULPHITE ROOM MUST HAVE LEAD FITTINGS AND ACID-PROOF CONSTRUCTION TO PREVENT THEIR DETERIORATION





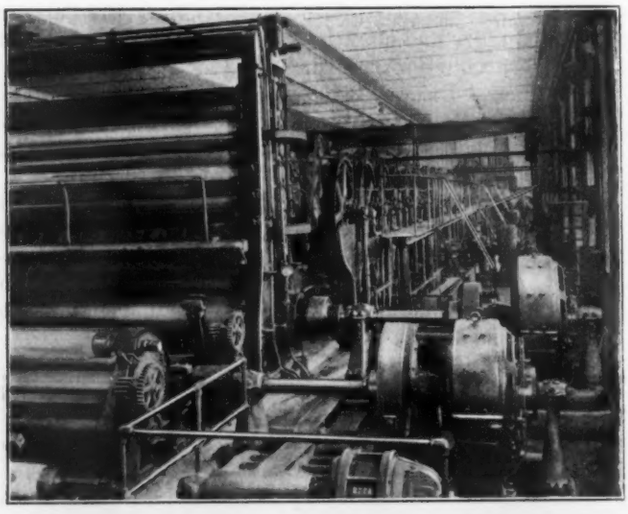
Many Motors Operate the Paper Machine

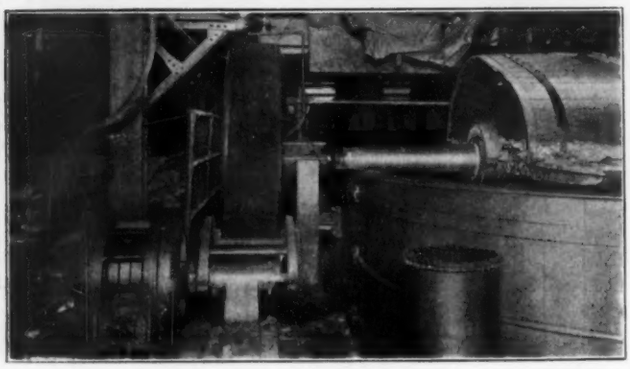
Upper view: An alternating-current motor drives the slitter and a direct-current motor with speed control is used on the rewinder.

Second view: Drum controllers and panel housings for wet end of a paper machine.

Third view: Each of the nine sections of the paper machine has its own motor drive.

Lower view: Motor-driven broke beater for two paper machines using Lenix belt drive.





Wood grinding furnishes an ideal load for synchronous motors as the grinders have light starting load when the pressure is relieved. They have a constant load characteristic regulated by an automatic device, and the total load is so great that the power factor for the whole plant is kept at unity. It is of interest to note that the induction motor load alone has a power factor of 72 per cent.

These synchronous motors are started by reduced voltage-tap compensators, and the power factor is controlled on the individual motors by their field rheostats. The motors are designed for 72 per cent leading power factor and 96.2 per cent efficiency at full load.

Each 2,400-hp. motor is direct-connected to the end of a shaft that carries two grindstones 60 in. in diameter by 54-in. face, thus making twelve stones in all. The seventh set, which will make fourteen stones, is being installed.

The grinders are of the Watrous magazine type—i.e., the wood is fed into vertical chambers that reach to the charging floor, where they are kept filled from wood bins that are in turn kept replenished by the conveyor system. The 4-ft. logs are laid in the magazine parallel to the shaft, making two compact stacks per stone in the magazines with the stone between them at the bottom. The logs that lie alongside the stone on either side are forced against the stone by hydraulic pistons until they are ground away. When the pistons have completed their strokes, they automatically withdraw, allowing more logs to fall into the vacant spaces, when the relentless forward travel of the pistons begins again. The withdrawal of the pistons is accomplished by the low-pressure 50-lb. water system, while the grinding pressure is applied by the 190-lb. water pressure, using, however, only about 150 lb. in service.

Without water the wood would burn and the stones would burst from heat; therefore some 6,000 gal. of white water is flushed over the twelve stones, serving to bring the ground wood away as pulp which is over 99 per cent water. Even so, the heat generated evolves a great amount of steam. This, however, is ejected by an ingenious system which leaves the department unusually clear. In the side of each magazine is a toothed wheel which is turned as the wood sinks toward the stone, and registers the cords of wood ground.

Provision is made for burring the stones at regular intervals by means of a built-in hydraulic burring lathe, without interfering with production, and a light burring at three-hour intervals is said to give very uniform results. Each stone, consuming about 900 hp., grinds 17 tons of air-dry pulp per twenty-four-hour day, and the pulp is of such high quality that refining processes usually resorted to are omitted in this mill.

The pulp after leaving the grinders passes through

TABLE III—ELECTRIC MOTOR DRIVES IN PUMP HOUSE
(Total connected load, 1,862.5 hp.; 550 volts, alternating current.)

Two 10-in., 2,000-g.p.m., 120-lb.-head fire pumps: Direct; two 200-hp., 1,200-r.p.m., squirrel-cage.	G. E.*
Two 20-in. vertical 10,000-g.p.m., 35-ft.-head pumps, river to filters: Direct; two 125-hp., 514-r.p.m., squirrel-cage.	G. E.
One 16-in. vertical 6,000-g.p.m., 35-ft.-head pump, river to filters: Direct; one 75-hp., 720-r.p.m., squirrel-cage.	G. E.
One 10-in. 1,800-g.p.m., 140-ft.-head pump, river to mill: Direct; one 100-hp., 1,800-r.p.m., squirrel-cage.	G. E.
Two 18-in. 10,000-g.p.m., 120-ft.-head pumps, filters to mill: Direct; two 400-hp., 1,200-r.p.m., wound rotor.	G. E.
One 10-in. 4,000-g.p.m., 120-ft.-head pump, filters to mill: Direct; one 200-hp., 1,800-r.p.m., squirrel-cage.	G. E.
One filter washer and air pump: Direct and chain; one 30-hp., 900-r.p.m., squirrel-cage.	G. E.
Screen washer: Gears; one 7½-hp., 1,140-r.p.m., squirrel-cage.	C. W.†

*General Electric. †Canadian Westinghouse.

inclined sliver screens having a large area, leaving the slivers on the surface, from which they are raked by chain-operated scrapers.

A tank holding 96,000 gal. receives the raw stock, together with the return of useful stock from the second screens further down the line. Still more white water is added in the knotter mixing box before the stock goes to the four improved Sherbrooke rotary-screen knotters. Fiber bundles and other overlarge units are washed off the upper inside surface of the drums and pass to the wrapper-machine system, as was the case in the sulphite department.

The stock now flows into long rifflers, which are fitted with submerged baffles to arrest sand from the stones and other heavy impurities. Four improved rotary first screens further refine the stock while they discharge undesirable matter to the second screens for a rescreening.

A battery of thirty deckers thickens the stock by removing all but about one-tenth of the water. This is done by rotating meshed drums partly submerged in the stock. The water runs into the drum and away to the ground-wood white-water tank, while the pulp left on the surface is scraped off and passes to the concrete cavelike ground-wood soft-stock tank, which holds 890,000 gal. A reserve tank can take 750,000 gal.

WASTE WATER LEAVES MILL PRACTICALLY CLEAR

The white water extracted from the pulp in both divisions and the overflow from the circulating system in the paper mill proper go to their respective white-water tanks. The sulphite tank gets a great quantity from the paper-mill tank, and the ground-wood white water is augmented by a small quantity from the same source. This water all contains valuable pulp, and both divisions make use of "save-alls" to recover a major portion of it. The ground-wood "save-alls" discharge pulp to a "save-all" stock tank, thence to the main soft-stock tank. The water with reduced pulp content passes to the "save-all" white-water tank, thence back into the system by way of the grinders, the sliver screens and the first screens.

In the sulphite department the "save-alls" discharge the recovered pulp directly to the main soft-stock tank. The reduced white water goes in a small part to the mixing box, to the first and second screens, while the major part goes to the sewer at the rate of about 20,000 tons per day. This is practically the only outlet of any size from the system, and by this time the water is practically free from pulp.

THE TWO KINDS OF PULP ARE NOW MIXED

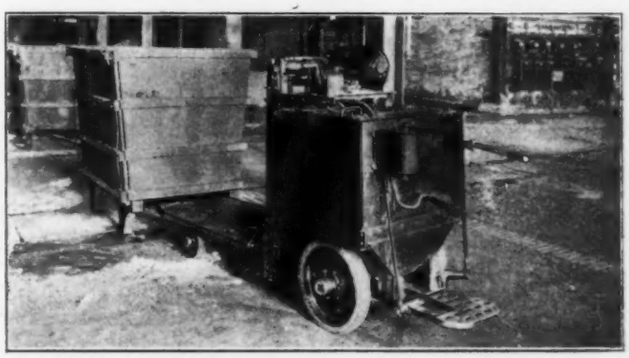
The pulp from both soft-stock tanks as it starts on its way to the mixing system has its consistency regulated by an automatic system which continually samples the flow and admits white water in such quantities as are

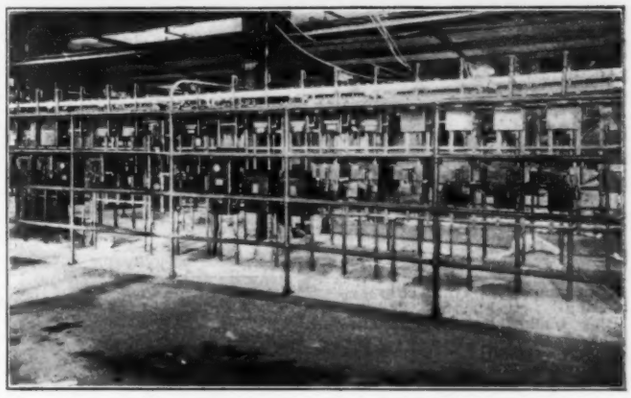
TABLE IV—ELECTRIC MOTOR DRIVES IN CHIPPER BUILDING

(Total connected load, 453 hp.; 550 volts alternating current.)

Washing drum:	
Belts and gears; one 50-hp., 860-r.p.m., wound rotor.	C. W.*
Knife barker:	
Belts; one 50-hp., 860-r.p.m., squirrel-cage.	C. W.
Conveyor to chippers:	
Gears; one 25-hp., 860-r.p.m., squirrel-cage.	C. W.
Two chippers:	
Belts; two 125-hp., 690 r.p.m., wound rotor.	C. W.
Two chipper screens:	
Belts and gears; one 50-hp., 860-r.p.m., squirrel-cage.	C. W.
Rechipper, blower and log splitter:	
Belts; one 25-hp., 860-r.p.m., squirrel-cage.	C. W.
Chipper-knife grinder:	
Belts; one 3-hp., 1,710-r.p.m., squirrel-cage.	Cr. Wh.†

*Canadian Westinghouse. †Crocker-Wheeler.





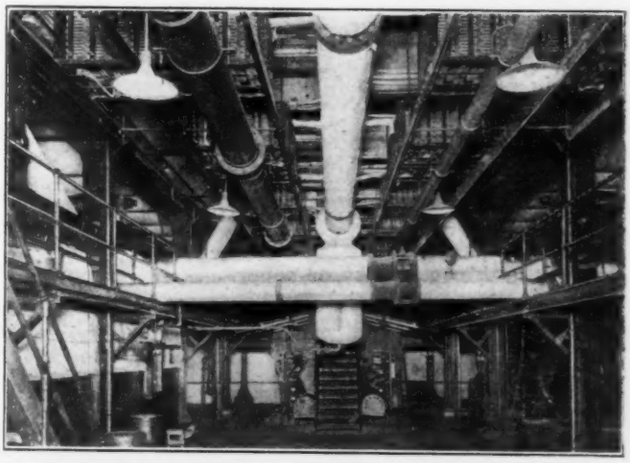
Each Paper Machine Is a Unit

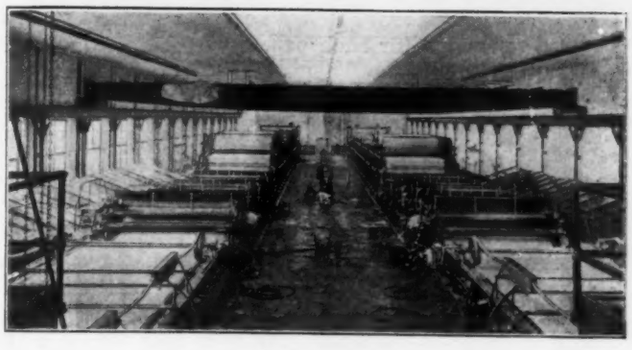
Upper view: A Lakewood elevating electric truck for carrying wet broke to broke beaters.

Second view: Switches and compensators for auxiliaries and paper machine sections.

Third view: Resistors and conduit in basement under dryers. Control panels for turbo-generators in center background.

Lower view: Bagley and Sewell 164 in. paper machines. Control units in center opposite dryers. Both machines making paper at 800 ft. per minute.





needed to keep the flow at a uniform consistency of 96.5 per cent water for the sulphite and the same for the ground-wood stock.

The two streams meet in the mixing system, wherein uniform heads are held against adjustable orifices. The heads are automatically held so that the two streams add 25 per cent and 75 per cent, or whatever other proportion is desired, to the whole. Incorporated with this unit are the feeds for the solution of alum and for the blue color. Both the Trimbly and Allen consistency regulators and the mixing system mentioned above are highly ingenious machines controlled by continuous-running fractional-horsepower motors whose importance in the general process is much greater than their sizes would indicate.

ANOTHER SCREENING PROCESS FOLLOWS

The two machine chests that next receive the "stuff" hold 225,000 gal. From here the stuff is pumped to four constant-level stuff boxes which have return overflows.

TABLE V—ELECTRIC MOTOR DRIVES IN DIGESTER AND ACID BUILDINGS
(Total connected load, 217.5 hp.; 550 volts alternating current.)

Chip conveyors from chipper building: Gears; 10-hp., 570 r.p.m., squirrel-cage.	C. W.*
Chip bucket elevator to chip bin: Gears; 35-hp., 860-r.p.m., wound rotor.	C. W.
Chip conveyor over chip bin: Gears; 15-hp., 900-r.p.m., squirrel-cage.	G. E.†
Two rotary sulphur burners: Gears; one 10-hp., 690-r.p.m., squirrel-cage.	C. W.
Gas blower to acid towers: Direct; one 10-hp., 900-r.p.m., wound rotor.	G. E.
One 2½-in. 250 g.p.m., 110-ft.-head water to acid towers: Direct; one 15-hp., 1,800-r.p.m., squirrel-cage.	G. E.
One 2½-in. 250-g.p.m., 110-ft.-head pump, acid to acid towers: Direct; one 15-hp., 1,800-r.p.m., squirrel-cage.	G. E.
Two 2½-in., 250-g.p.m., 50-ft.-head pump, acid to storage: Direct; two 7½-hp., 1,800-r.p.m., squirrel-cage.	G. E.
Two 8-in., 1,600-g.p.m., 65-ft.-head pumps, acid to digester: Direct; two 40-hp., 1,800-r.p.m., squirrel-cage.	G. E.
Acid tower elevator: Geared; one 10-hp., 900-r.p.m., wound rotor.	O. F.‡
Digester building elevator: Geared; one 10-hp., 900-r.p.m., wound rotor.	O. E.‖
Ventilating fans: Three 5-hp., 1,800-r.p.m., squirrel-cage.	C. W.

*Canadian Westinghouse. †General Electric. ‡Otis Fensom. ‖Otis Elevator.

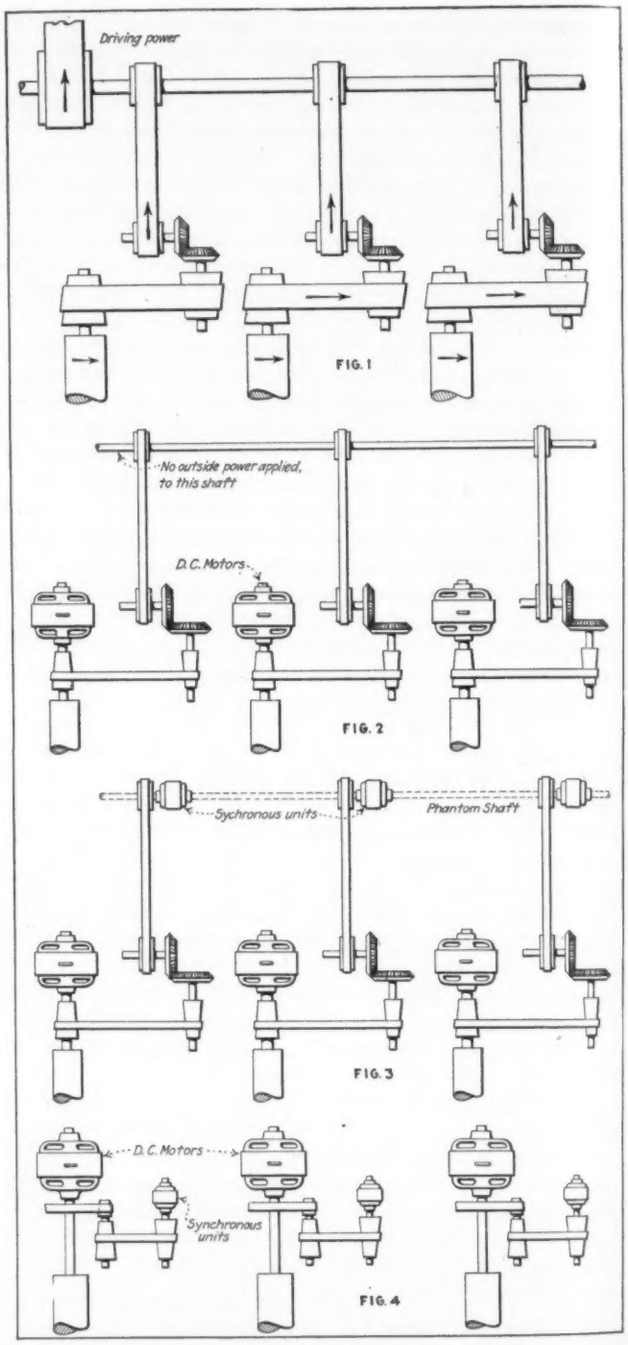
Next in order are the four mixing boxes, where the 1,600-g.p.m. flow is boosted to 14,000 g.p.m. by the circulating white water, about 64,000 tons being passed through the four machines every twenty-four hours. Each paper machine is preceded by three inward-flow rotating Bird screens which remove the last traces of undesirable matter and thoroughly agitate the fibers to insure a uniform quality of paper.

The tailings from the Bird screens go to second screens, where the rejected material is removed by hand and the material passed goes back to the paper machines.

The four Bagley & Sewell 164-in. paper machines are placed side by side in the machine room, which is 175 ft. wide and 320 ft. long. They are driven by the General Electric Company's sectionalized electric drive, using direct-current motors which take their current from a turbine-generator for each paper machine.

PAPER MACHINES HAVE SECTIONAL DRIVE

One paper machine is made up of nine independent sections, which, however, are intimately related as to speeds in linear feet per minute. These speeds, though slightly different for each section, are required to be maintained in precise adjustment in order to produce an unbroken sheet of uniform quality. At a speed of 800 ft. per minute the "stuff," 99½ per cent water, is converted into specification paper containing 10 per cent water in forty-five seconds. It is a race between the



THE EVOLUTION OF PAPER MACHINE DRIVE FROM ALL MECHANICAL TO SECTIONALIZED ELECTRICAL

water content on the one hand and gravity, suction, pressure and heat on the other hand.

The first section is the Fourdrinier wire, an endless belt of fine brass mesh the width of the machine. It runs around two rolls about 50 ft. apart, one of which, the couch roll, is driven by a directly connected motor. The upper surface of the "wire" is supported by a number of small table rolls, and near the couch roll and inside of the couch roll as well are installed a number of suction boxes extending the entire width in which a vacuum of 10 in. to 16 in of mercury is maintained.

A uniform stream of stock about ⅝ in. deep the entire width of the wire belt is poured on with a velocity practically equal to that of the wire. During the three seconds that elapses while passing to the couch roll the greater part of the water falls through the wire mesh

and the fibers are left in a felted sheet, which is further compacted by the forcible extraction of water as it passes over the suction boxes.

At the couch roll the deposited fibers have become paper. This is still 75 per cent water, but it has sufficient strength to withstand the strain of being peeled from the wire, whence it passes over an open space unsupported to the wool-felt-carrying member of the next section, which is the first press.

It can readily be seen that the speeds of these two sections must be adjusted with microscopic accuracy in order that the delicate web may not be overstretched on the one hand or not be carried away fast enough on the other hand. Through the press sections, of which there are four in series (three in use), each with its motor drive, the paper is carried on wool-felt between rollers under heavy pressure. The top rolls are made of polished granite with the pressure further augmented by compounded levers carrying weights. The bottom roll of the first press is provided with a vacuum box. These presses reduce the water content from 75 per cent to about 66 per cent, during which process the strength of the sheet is very materially increased.

The next unit, by far the largest and heaviest of all, is the dryer section, which consists of forty-four finished revolving cast-iron drums each 5 ft. in diameter by 13½ ft. long and heated by the exhaust steam from the turbine. This steam still holds about 88 per cent of the heat that it contained as it came from the boilers. The drums are all geared together and are fitted with a canvas belt having a total length of more than 600 ft. and as wide as the machine, since it must carry the paper. Means are provided for extracting the condensate from the rolls and returning it for boiler feed. The rate and extent of drying is controlled by adjusting the back pressure on the turbine. This section requires two motor drives on account of the great length of the train of gears.

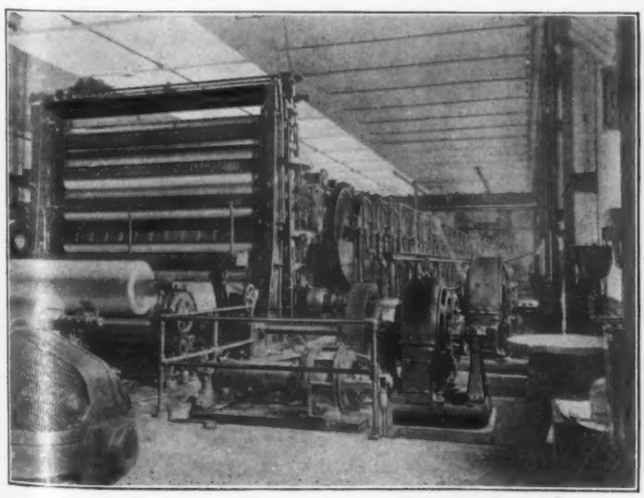
There is also provided an auxiliary alternating-current drive for this section with a large gear reduction which is used for convenience in starting or for low-speed operation of the drives. The combined weight of all the rolls in this section is 375 tons and the starting duty is very high, principally owing to bearing friction. About 15,000 lb. at 1 ft. radius is required to start the section after a shutdown of a few hours. The mass inertia prolongs the starting load, as the 375 tons of revolving parts are made up almost entirely of 5 ft. drums. The section can be started by the direct-current motors alone by a special switching arrangement which puts the two motor armatures in series, thus relieving the load on the turbine generator. The alternating-current motor for starting and running up to 80 ft. per minute allows for the adjustment and renewal of "felts" or repairs on Sunday without operating the 500-kw. direct-current turbine.

TABLE VI—ELECTRIC MOTOR DRIVES IN SULPHITE SCREEN ROOM

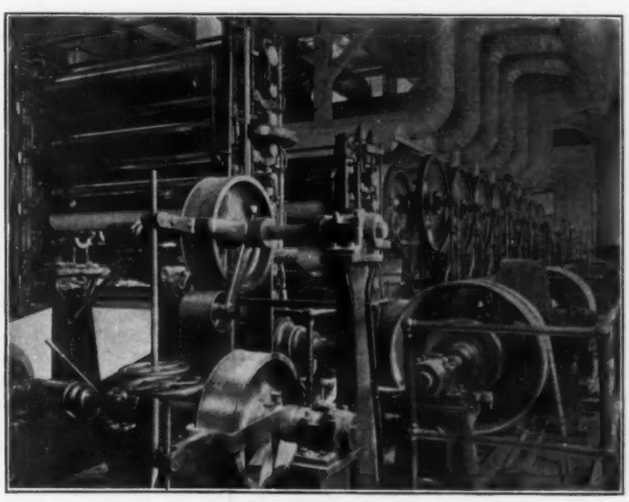
(Total connected load, 1,440 hp.; 550 volts alternating current.)

One 10-in., 1,800-g.p.m., 135-ft.-head, white water to pits: One 100-hp., 1,800-r.p.m., squirrel-cage.	G. E.*
One agitator blow-pit soft-stock tank: One 25-hp., 690-r.p.m., squirrel-cage.	C. W.†
One knotter screen: One 5-hp., 860-r.p.m., squirrel-cage.	C. W.
Three first screens and one second screen (rotaries): One 150-hp., 790-r.p.m., squirrel-cage.	G. E.
One 5-in. 500-g.p.m., 160-ft.-head pump, white water shower to screens: One 40-hp., 1,800-r.p.m., squirrel-cage.	G. E.
One 10-in., 2,500-g.p.m., 45-ft.-head pump, white water to screens: One 42-hp., 1,200-r.p.m., squirrel-cage.	G. E.
One 10-in., 3,865-g.p.m., 20-ft.-head pump, stock screens to washers: One 40-hp., 720-r.p.m., squirrel-cage.	G. E.
One 3-in., 300-g.p.m., 200-ft.-head, pump, showers to washers: One 24-hp., 1,800-r.p.m., squirrel-cage.	G. E.
Four sulphite stock washers, four drums each: One 25-hp., 860-r.p.m., squirrel-cage.	C. W.
Two agitator, screen-room soft-stock chests: Two 25-hp., 690-r.p.m., squirrel-cage.	C. W.
One 1,360-g.p.m., 25-ft.-head pump, white water to "save-alls": One 15-hp., 1,200-r.p.m., squirrel-cage.	G. E.
One 600-g.p.m., 28-ft.-head pump, "save-all" stock to tank: One 10-hp., 900-r.p.m., squirrel-cage.	G. E.
One agitator, sulphite soft-stock tank: One 10-hp., 720-r.p.m., squirrel-cage.	G. E.
One 620-g.p.m., 41-ft.-head pump, sulphite stock to mixer: One 20-hp., 1,200-r.p.m., squirrel-cage.	G. E.
Two stock consistency regulators: Two 0.1-hp., 1,750-r.p.m., squirrel cage.	R. & M.‡
Color pumps: One 5-hp., 690-r.p.m., squirrel-cage.	C. W.
Mixer for G. W. stock, sulphite stock, alum and color: One 0.5-hp., 1,750-r.p.m., squirrel-cage.	R. & M.
Beater for sulphite laps: One 50-hp., 690-r.p.m., wound rotor.	C. W.
Wet machine No. 1: One 50-hp., 690-r.p.m., wound rotor.	C. W.
Wet machine No. 2: One 50-hp., 860-r.p.m., wound rotor.	C. W.
One 2½-in., 250-g.p.m., 50-ft.-head pump, showers to wet machines: One 7.5-hp., 1,800-r.p.m., squirrel cage.	G. E.
Four Jordans: Four 150-hp., 327-r.p.m., squirrel-cage.	G. E.
Screen room fan: One 5-hp., 1,730-r.p.m., squirrel-cage.	C. W.

*General Electric. †Canadian Westinghouse. ‡Robbins & Myers.



PAPER MACHINE FROM DRY END SHOWING MOTORS ON CALENDER REEL AND REWINDER



WRAPPER MACHINE FROM DRY END SHOWING LINE SHAFT THROUGH CONE PULLEYS

TABLE VII—ELECTRIC MOTOR DRIVES IN GROUND WOOD MILL

(Total connected load, 15,100 hp.; 2,300 volts alternating current.)

One conveyor cross-connecting long conveyors over charging floor:	
One 10-hp., 690-r.p.m., squirrel-cage.	C. W.*
Two conveyors, 220 ft. long over charging floor:	
Two 25-hp., 900-r.p.m., squirrel-cage.	G. E.†
Cut-off saw charging floor:	
One 5-hp., 1,800-r.p.m., squirrel-cage.	Cr. Wh.‡
Ventilating fan charging floor:	
One 7.5-hp., 720-r.p.m., squirrel-cage.	C. W.
Air compressor:	
One 2-hp., 1,800-r.pm., squirrel-cage.	G. E.
Two heater fans, grinding room, 15,000 cu.ft. per minute:	
Two 5-hp., 1,800-r.p.m., squirrel-cage.	C. W.
Heater-fan grinder building:	
One 15-hp., 900-r.p.m., squirrel-cage.	G. E.
Heater-fan screen room:	
15-hp., 690-r.p.m., squirrel-cage.	C. W.
Ventilating fan, grinder floor:	
One 5-hp., 860-r.p.m., squirrel-cage.	C. W.
Two motor-generator exciter sets for grinder motors:	
Two 350-hp., 1,200-r.p.m., 2,200-volt	G. E.
Two 225-kw., 1,200-r.p.m., 125-volt direct-current generators.	G. E.
Two oil pumps for grinder load regulators:	
Two 2.5-hp., 1,200-r.p.m., 110-volt, direct-current.	G. E.
Grindstone trimmer:	
One 10-hp., 900-r.p.m. wound rotor.	G. E.
Two 3-in., 266-g.p.m., 404-ft.-head, four-stage pumps, high pressure:	
Two 50-hp., 1,800-r.p.m., squirrel-cage.	G. E.
Two 480-g.p.m., 201-ft.-head pumps, low-pressure grinder, jack water:	
Two 50-hp., 1,800-r.p.m., squirrel-cage.	G. E.
Six two-stone magazine grinders:	
2,652-kva., 240-r.p.m., 2,200-volt synchronous.	G. E.

(Total connected load, 14,150 hp.; 500 volts alternating current.)

Two sliver screens:	
One 15-hp., 720-r.p.m., squirrel-cage.	G. E.
One 6,300-g.p.m., 41-ft.-head pump, white water to grindstone:	
One 100-hp., 1,620-r.p.m., squirrel-cage.	G. E.
One 252-g.p.m., 97-ft.-head pump, "save-all," white water to grinder showers:	
One 100-hp., 1,200-r.p.m., squirrel-cage.	G. E.
Four rotary knotters:	
One 10-hp., 860-r.p.m., squirrel-cage.	C. W.
Two 14-in., 5,000-g.p.m., 57-ft.-head pumps, stock to knotters:	
Two 100-hp., 900-r.p.m., squirrel-cage.	G. E.
One 3-in., two-stage, 300-g.p.m., 200-ft.-head pump, filtered water shower and first screen:	
One 25-hp., 1,180-r.p.m., squirrel-cage.	G. E.
Two second screens:	
One 50-hp., 750-r.p.m., wound rotor.	G. E.
Thirty deckers in groups of five:	
Six 25-hp., 600-r.p.m., wound rotor.	G. E.
One 2,400-g.p.m., 83-ft.-head pump decker, white water to tank:	
One 75-hp., 1,200-r.p.m., squirrel-cage.	G. E.
Two white-water pumps to "save-alls":	
Two 7.5-hp., 570-r.p.m., squirrel-cage.	C. W.
One 6-in. 98-ft.-head pump, "save-all," stock to decker stock tank:	
One 30-hp., 1,800-r.p.m., squirrel-cage.	G. E.
One 1,700-r.p.m., 60-ft.-head pump, "save-all," white water to screen showers:	
One 40-hp., 1,800-r.p.m., squirrel-cage:	G. E.
One 10-in., 25-ft.-head pump, rejections from fine screens:	
One 30-hp., 900-r.p.m., squirrel-cage.	G. E.
One pump rejections from second screens to wrapping machine system:	
One 100-hp., 720-r.p.m., squirrel-cage.	G. E.
One vertical 80-g.p.m., 25-ft.-head pump, sump pit to sewer:	
One 5-hp., 1,300-r.p.m., squirrel-cage.	C. F.‖
One 1,350-g.p.m., 96-ft.-head pump, stock to mixing system:	
One 50-hp., 1,200-r.p.m.. squirrel-cage.	G. E.

*Canadian Westinghouse. †General Electric. ‡Crocker-Wheeler. ‖Canadian Fairbanks.

The paper now goes to the calender, which is made up of ten polished steel rolls in a vertical stack, with a 100-hp. motor directly connected to the bottom roll. The paper goes to the top of the stack and passes in and out between the rolls to the bottom, where it emerges a bright, smoothly finished sheet of paper.

The reel just beyond the calender rolls up the product into units weighing about 1½ tons. While not affecting the nature of the paper, this unit has also to be intimately tied in as to speed with the other sections. The entire course through the paper machine takes about forty-five seconds.

These reels of paper are lifted by means of an electric parallel-motion hoist to stands, from which the paper is run through the slitter, which trims off the edges and slits the paper into two or more parts. The rewinder now rewinds the paper on paper tubes with metal ends that are adapted to the printing presses on which the paper will be used. It is usual to make two 73½-in. rolls, each weighing about 1,400 lb. The rewinder is driven by a 30-hp. motor with speed control by means of a rheostat in the field of an alternating-current-motor-driven direct-current generator in the basement. The trimmings from the sheet and other "broke" resulting from various causes are put through a beater in the basement, which reduces the wet or dry broke to pulp that can be returned to the system at the machine chest.

The commercial rolls are now taken to the finishing

TABLE VIII—ELECTRIC MOTOR DRIVES FOR ONE OF FOUR 164-IN. PAPER MACHINES

(Total connected load, 488 hp.; 550 volts, alternating current.)

One 2,900-g.p.m., 56-ft.-head pump, stock from chest to mixing box, common to 4 machines:	
One 60-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.*
One 2,000-g.p.m., 28-ft.-head pump, suction white water to mixing box:	
One 25-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One 4,800-g.p.m., 40-ft.-head pump, stock to machine screens:	
One 75-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
Four rotary machine screens:	
Four 5-hp., 600-r.p.m., 550-volt, A.C., squirrel-cage.	C. W.
One 1,000-g.p.m., 70-ft.-head pump, fresh water to showers:	
One 30-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One Fourdrinier shaker (not used):	
One 1-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
Two Nash vacuum pumps, Fourdrinier suction boxes and couch suction box:	
Two 100-hp., 720-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One turbine-generator set for driving nine sections of paper machine:	
One 500-kw., 900-r.p.m., 330-volt, D.C. generator.	G. E.
One 35-kw., 900-r.p.m., 125-volt, D. C. exciter.	G. E.
One Fourdrinier section drive at couch roll:	
One 150-hp., 136-r.p.m., 245-volt, D.C.	G. E.
One 20-hp., 857-r.p.m., 210-volt, synchronous unit.	G. E.
One Nash vacuum pump, first press suction roll:	
One 100-hp., 750-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One first press drive:	
One 100-hp., 143-r.p.m., 245-volt, D.C.	G. E.
One 20-hp., 857-r.p.m., 210-volt, synchronous unit.	G. E.
Three second, third and fourth press drives:	
Three 50-hp., 151.3-r.p.m., 245-volt, D.C.	G. E.
Three 20-hp., 857-r.p.m., 210-volt, synchronous units.	G. E.

(Total connected load, 630 hp.; 245 volts, direct current.)

One dryer (two-motor drive):	
Two 100-hp., 150.1-r.p.m., 245-volt, D.C.	G. E.
One 20-hp., 857-r.p.m., 210-volt, synchronous unit.	G. E.
One dryer (starting and slow running) "kicker":	
One 30-hp., 1,800-r.p.m., 550-volt, A.C., wound rotor.	G. E.
One calender drive:	
One 100-hp., 147.7 r.p.m., 245-volt, D.C.	G. E.
One 20-hp., 857-r.p.m., 210-volt, synchronous unit.	G. E.
One fan for broke from calender to broke heater:	
One 15-hp., 1,150-r.p.m., 550-volt, A.C., squirrel-cage.	C. W.†
One calender-roll hoist gear:	
One 10-hp., 900-r.p.m., 550-volt, A.C., wound rotor.	G. E.
One reel drive:	
One 30-hp., 98.5-r.p.m., 245-volt, D.C.	G. E.
One 20-hp., 857-r.p.m., 210-volt, synchronous unit.	G. E.
One reel hoist:	
One 3-hp., 1,200-r.p.m., 550-volt, A.C.	N. W.‡
One slitter drive:	
One 3-hp., 1,200/900-r.p.m., 550-volt, A.C., wound rotor.	G. E.
One fan to blow trimmings from slitter to broke beater:	
One 3-hp., 1,750-r.p.m., 550-volt, A.C., squirrel-cage.	C. W.
One motor-generator set for rewinder drive:	
One 50-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One 32-kw., 1,200-r.p.m., 250-volt, D.C.	G. E.
One rewinder drive:	
One 35-hp., 330-r.p.m., 245-volt, D.C.	G. E.
One hoist for rewinder:	
One 3-hp., 1,200-r.p.m., 550-volt, A.C.	N. W.

*General Electric. †Canadian Westinghouse. ‡North West.

room, where they are securely protected by heavy wrapping paper made from the rejections of the sulphite and ground-wood mill.

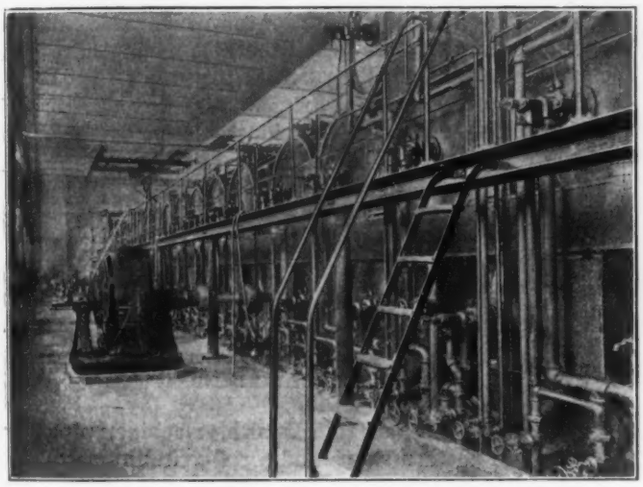
SECTIONALIZED PAPER-MACHINE DRIVE AN ACHIEVEMENT OF NOTE

Sectionalized motor drive for a paper machine presents one of the most exacting and complex of the thousands of special applications of electric motors to industrial arts.

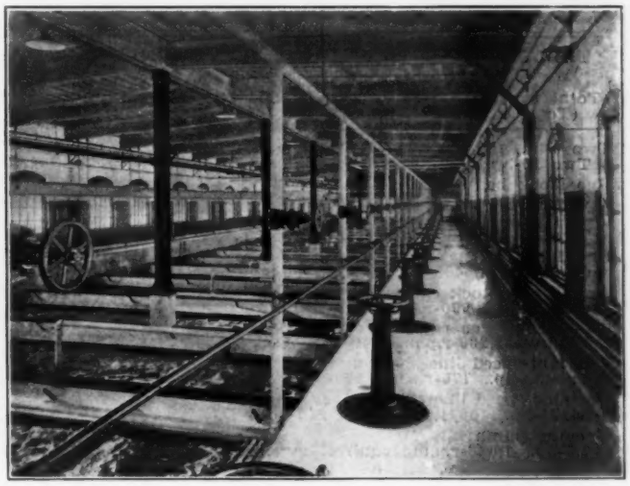
(a) In order to compete it must use less power, must save space and must cost less to maintain than the conventional mechanical line-shaft drive.

(b) In order to operate successfully it must allow for a wide range of speed in paper production. It must be easily adjusted for "stretch or draw" between the sections and must hold that adjustment unchanged either by creepage or hunting. It must enable the operator to slow down or stop any section without disturbing the others. All its members and attendant control features must be sturdy and self-reliant to operate where inspection is possible only at 160-hour intervals.

All these rigid specifications are met on these machines as they have been on many others.



DRYER SECTION OF PAPER MACHINE SHOWING 100-HP. D.C. DRIVING MOTOR



TWENTY SAND FILTER BEDS HAVE A CAPACITY OF 20,000,000 GAL. PER DAY

OPERATION.

The General Electric sectionalized drive is operated in the following manner. In the basement below each paper machine there is installed a 500-kw. direct-current-geared turbine-generator shaft. The line voltage determines the rate of production on the paper machines and is 185 volts for 800 ft. per minute, with a workable range from 500 ft. to 1,200 ft. per minute. This voltage is controlled from the machine room by a chain-operated rheostat in the 500-kw. generator field. The turbine speed and the exciter voltage are held constant.

The motors driving the various sections have their fields energized by the 125-volt exciter. They are large, low-speed units designed for about 150 r.p.m. at 245 volts so as to avoid the interposition of gears. The couch roll and calender stack each take a 100-hp. motor, while the presses each take a 50-hp. motor, the dryer two 100-hp. motors and the reel a 30-hp. and the rewinder a 35-hp. motor, all of the shunt-wound interpole type.

With the exception of the rewinder motor and the second motor on the dryer, each motor is accompanied by a 20-hp. synchronous motor—or generator, as the case for the moment may be—and these synchronous tie-in units are all connected to a common three-wire, three-phase bus to which nothing else is connected. Their fields are energized from the 125-volt exciter. These synchronous units are belted through cone pulleys to the direct-current motors, with the exception of the first dryer motor. In that case the cone pulleys are dispensed with as the speed of this unit is taken as par and the "stretch and draw" of the other sections are regulated to this base speed.

The effect of these synchronous units tied in as they are is similar to that of a great flywheel which can be neither delayed nor hurried. With all the motors running, any direct-current motor and the section it drives may be adjusted as to speed by moving the belt along on the cone pulleys. If the direct-current motor field strength is right, the synchronous unit will be simply idling, as indicated by its ammeter. Should the direct-current motor be inclined to run faster, the synchronous unit becomes a generator giving energy to the other similar units which for the time may be performing as motors. This puts a restraining load on the direct-current motor and effectually holds it in line. Conversely, if a direct-current motor is inclined to slow down, its attached synchronous unit would supply aid as a motor again, effectually holding the section in line.

These guide units can aid or hold back up to 40 hp. each, and by occasional hand adjustment of the direct-current motor-field rheostats these exchanges of loads can be kept near to zero. Little attention is paid to the loads on these units, however, and the meters bear only a center mark and outside limit marks. Any change in the load on one unit affects the other eight by only one-eighth of the change. The belt shifter is brought through to the front of the machine, and the machine tender can change the speed of a section by a fraction of 1 per cent with the assurance that it will hold that place until he makes a further change.

When it is necessary to slow down or stop an individual section, the ordinary drum controller is resorted to, and its first step disconnects the synchronous unit from the common bus. Thereafter the section is controlled in the ordinary manner. After the section is brought up to normal speed the synchronous unit is tied in by

TABLE IX—ELECTRIC MOTOR DRIVES COMMON TO THE FOUR PAPER MACHINES
(Total connected load, 633 hp., 550 volts, alternating current.)

Two broke beaters: Two 50-hp., 720-r.p.m., 550-volt, A.C., wound rotor.	G. E.*
Two agitators in broke-stock chests: Two 5-hp., 690-r.p.m., 550-volt, A.C., squirrel-cage.	C. W.†
Two 6-in., 800-g.p.m., 57-ft.-head pumps, broke stock to machine chests: Two 25-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
Two air compressors: Two 100-hp., 690-r.p.m., 550-volt, A.C., squirrel-cage.	C. W.
Four machine-room heater fans: Four 25-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
Four machine-room heater fans: Four 15-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
Four finishing-room heater fans: Four 3-hp., 1,120-r.p.m., 550-volt, A.C., squirrel-cage.	C. W.
One pump, hot-water return from heating system: One 15-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
Two wet broke-truck battery chargers: Two 3.5-hp., 1,150-r.p.m., 550-volt, A.C.	E. P.‡
One finishing-room rewinder. One 25-hp., 860-r.p.m., 550-volt, A.C., wound rotor.	C. W.
Two elevators between finishing and shipping departments: Two 27-hp., 600-r.p.m.	O. F.‖

*General Electric. †Canadian Westinghouse. ‡Electric Products. ‖Otis Fensom.

TABLE X—ELECTRIC MOTOR DRIVES IN WRAPPER-MACHINE DEPARTMENT
(Total connected load, 335 hp.; 550 volts, alternating current.)
(Total connected load, 105 hp.; 240 volts, direct current.)

Two 6-in., 700-r.p.m., 25-ft.-head pumps, wrapper-stock beater: Two 10-hp., 900-r.p.m., squirrel-cage.	G. E.*
One stock beater: One 50-hp., 750-r.p.m., wound rotor.	G. E.
Two Claflin refiners: Two 75-hp., 430-r.p.m., squirrel-cage.	C. W.†
One Jordan: One 100-hp., 400-r.p.m., squirrel-cage.	G. E.
Agitator in stock chest: One 15-hp., 690-r.p.m., squirrel-cage.	C. W.
One turbine-generator set: 100-kw., 1,200-r.p.m., 240-volt, D.C.	G. E.
Constant-speed line-shaft drive: One 30-hp., 775-r.p.m., 230-volt, D.C.	G. E.
Variable-speed line-shaft drive: 36/75-hp., 400/1,000-r.p.m., 240-volt, D.C.	G. E.
Vacuum pump: 7.5-hp., 1,800-r.p.m., squirrel-cage.	G. E.
Exhaust fan: One 15-hp., 690-r.p.m., squirrel-cage.	C. W.

*General Electric. †Canadian Westinghouse.

TABLE XI—ELECTRIC MOTOR DRIVES IN SHOPS
(Total connected load, 174 hp.; 550 volts, alternating current.)

One line shaft and blacksmith blowers: One 10-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.*
One line shaft, machine shop: One 15-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One pipe threader: One 5-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One ventilating-fan machine shop: One 10-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One welding set: One 7.5-hp., 1,800-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One planer: One 10-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One shaper: One 5-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One keyseater: One 5-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One drill press: One 5-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One roll grinder: One 10-hp., 900-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
Two 5-hp., 1,200-r.p.m., 550-volt, A.C., squirrel-cage.	G. E.
One pipe cutter: One 10-hp., 860-r.p.m., 550-volt, A. C., squirrel-cage.	G. E.
Two line shafts, pattern shop and carpenter shop: Two 30-hp., 860-r.p.m., 550-volt, A.C., squirrel-cage.	C. W.†
Two heater fans, pipe and machine shops: Two 5-hp., 1,720-r.p.m., 550-volt, A.C., squirrel-cage.	C. W.
One elevator, machine shop: One 25-hp., 900-r.p.m., 550-volt, A.C.	A. B. S.‡
One concrete mixer: One 15-hp., 1,140-r.p.m., 550-volt, A.C.	Wag.‖
One air compressor, portable: One 1-hp., 725-r.p.m., 550-volts, A.C.	Wag.

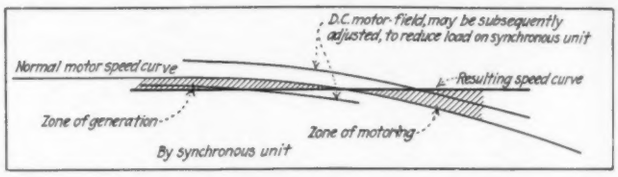
*General Electric. †Canadian Westinghouse. ‡A. B. See. ‖Wagner.

pushing a button at the controller. Should the motor-overload circuit breaker open, it also disconnects the guide unit.

After a complete shutdown, as, for instance, to put in a new Fourdrinier wire, all the sections can be restarted, brought up to speed and tied in as fast as the controllers can be handled. The tying in by the synchronous units does not require any special manipulation, as, being belted to their respective sections, they are always so closely in accord that there need be no delay on their account.

As previously mentioned, the wrapper machine takes the rejected material from the ground-wood screen room and sulphite screen room and converts it into heavy wrapping paper, making about 10 tons in eight hours. The stock passes through beaters and Jordans and then to the wrapper-machine room. The wrapper machine is of the cylinder type and is driven by two motors, one on the constant-speed line shaft carrying auxiliaries and one on the variable-speed shaft driving the paper machine itself. These are both direct-current motors operated by a turbo-generator set which carries 30 lb. back pressure in order that the steam may have sufficient heat to dry this very thick paper.

The shop machinery is driven both in groups through line shafting and with individual motors connected to


D.C. motor field, may be subsequently adjusted, to reduce load on synchronous unit
Normal motor speed curve
Resulting speed curve
Zone of generation
Zone of motoring
By synchronous unit

RANGE OF MOTOR PERFORMANCE IN THE SECTIONALIZED PAPER MACHINE DRIVE

machines. There are blacksmith, machine, pipe, carpenter and pattern shops and a roll-grinding room fully equipped to handle all routine work of mill maintenance.

The lighting of this mill is particularly well distributed and was laid out with a view to economy without sacrificing light where light is needed. There are about 1,200 tungsten lamps averaging 100 watts and actually running from 75 watts to 200 watts. They are fed by open conduits, using condulets for outlets, and are all equipped where practicable with 18-in. white enameled reflectors. The lighting load is about 120 kw.

In this mill, the only one 100 per cent electrified mill in the paper industry, may be found practical applications of electric power in many forms. The pumping of water and stock forms a large percentage of the load, and the combined output of the pumps is about 140,000 gal. per minute. A reference to the diagram showing the water content in the materials as they pass through the various operations will indicate how important these units are. The grinding of wood on such a wholesale plan by electric motors, while not new, is so well worked out here that it is worthy of considerable study. Only in very recent years has it been considered feasible to grind wood other than by direct application of water power. The hundreds of wide scattered auxiliary units of every conceivable type could certainly not be located so conveniently or operated so economically with any other form of power transmission than electric motor drive. Finally, the sectional motor drive of the paper machines themselves is a very fine development of special industrial engineering and works out very much to the satisfaction of the trade.

Lansing to Have Architecturally Uniform Lighting System

Plan Whereby Every Paved Street Will Ultimately Be Lighted from Ornamental Underground-Fed Standards—Five Classes of Illumination Adapted to All City Streets

By OSCAR E. BULKELEY
Superintendent Board of Water and Electric Light Commissioners

LANSING, the capital of Michigan, will be the first city in the United States to have an architecturally uniform system of street-lighting units. A comprehensive scheme which will provide eventually for the illumination of every paved street by ornamental, underground-fed standards has been adopted, and the first 350 units are now being installed. The lighting plan was formulated by the writer in consultation with illuminating engineers of the General Electric Company and was an outgrowth of a general feeling of dissatisfaction with the existing boulevard lighting system, which is not only poorly designed but inefficient. It was realized that the time was opportune for a change, while the investment in the existing lighting system was still comparatively small, while no great loss would be involved in replacement, and before making a substantial additional investment for extending the system. This was especially true since the contemplated extensions included the most important thoroughfares in the city.

The scheme adopted divides the illumination into five classes according to types of streets and their lighting requirements, as follows: The principal business streets, the secondary business streets, the main boulevards and thoroughfares, the secondary residential streets, the parks, plazas and other open places.

The standards and lighting units on all streets will be of the same architectural family and will harmonize in design with one another and with their surroundings. Thus the distressing variance in types that is so often noticeable where a city's lighting equipment has been acquired piecemeal will be absent in Lansing. On the contrary, a novel and very pleasing uniformity in appearance will characterize the plan.

This installation will be the first in which the design, known by some as the Saratoga unit, will be produced in alabaster rippled glass, this pattern having heretofore been restricted to globes having a diffusing surface. This will give an added element of distinctiveness to Lansing's new system.

INTENSIVE LIGHTING ON BUSINESS THOROUGHFARES

Intensive lighting will be used in the main business sections of Washington and Michigan Avenues. In these sections standards 20 ft. from ground to light source, carrying two form 12 "Novalux" units with medium alabaster rippled globes and canopies, each equipped with a 10,000-lumen (1,000-cp.), 20-amp. series tungsten lamp are proposed. In the bases of the standards will be installed type IL transformers with taps that will permit the future use of 15,000-lumen (1,500-cp.) lamps. This transformer raises the 6.6-amp. line current to 20 amp. Not only will this provide for the use of the more efficient high-current lamp, but it will effectively insulate the pole from the high voltage of the underground circuit and protect the lamp from line surges. The standards are to be spaced from 110 ft. to 135 ft. apart and opposite each other. At present the business district is inadequately lighted by obsolete cluster-type standards, although there are now installed nearly double the number of standards contemplated in the new lighting system.

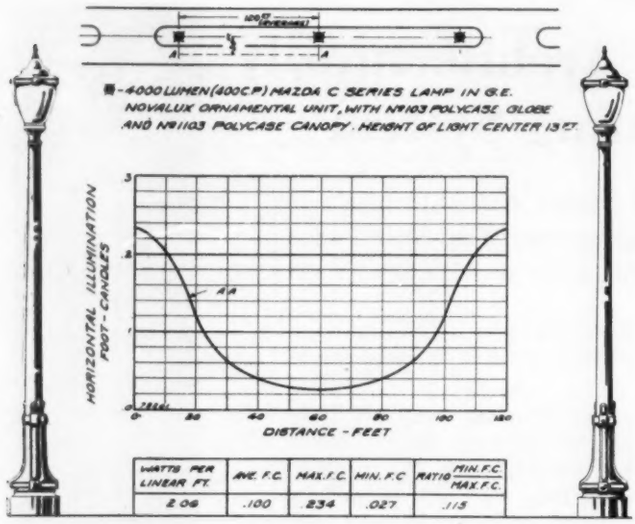
Similar units to those just described will be installed along secondary business streets, with the difference that only one unit to a standard will be used. The standards will be approximately 15 ft. from the ground to the light source. On the more important secondary streets and on the principal streets beyond the two-light standards 10,000-lumen (1,000-cp.) lamps are planned. In other locations 6,000-lumen (600-cp.) lamps, with provision for the use later of 10,000-lumen lamps, will be used.

SPACING OF UNITS AND STAGGERING OF STANDARDS CONFORM TO STREET WIDTHS

The spacing of the units on these secondary streets will vary with the width and importance of the street. On the narrow ones the standards will be staggered, with one every 55 ft. or 75 ft. On wide streets the standards will be placed opposite one another at intervals of from 100 ft. to 125 ft. as this staggering will produce better illumination.

The main boulevards and thoroughfares are the principal routes for incoming and outgoing traffic and hence demand lighting that will make it possible to drive an automobile through them at a moderate speed without the use of bright headlamps. In these installations 4,000-lumen (400-cp.) tungsten lamps in form 8 "Novalux" "Polycase" glassware will be used, mounted on a King Manufacturing Company's standard of French design, providing for a height of 13 ft. to the light source. The spacing will be approximately 100 ft. at street intersections, increasing to a maximum of 140 ft.

Pennsylvania Avenue is an example of a broad boulevard having a grass parkway in the center ornamented


1-4000 LUMEN (400 C.P.) MAZDA C SERIES LAMP IN G.E. NOVALUX ORNAMENTAL UNIT, WITH NO 103 POLYCASE GLOBE AND NO 1103 POLYCASE CANOPY. HEIGHT OF LIGHT CENTER 13 FT.
HORIZONTAL ILLUMINATION FOOT-CANDLES
DISTANCE - FEET
A-A
WATTS PER LINEAR FT. | AVE. F.C. | MAX. F.C. | MIN. F.C. | RATIO MIN. F.C. / MAX. F.C.
2.04 | .100 | .234 | .027 | .115

LIGHT DISTRIBUTION CURVE AND DATA ON INTENSITIES FOR A TYPICAL UNIT

with shrubs and flower designs, on either side of which is a paved driveway. There will be a single row of the boulevard-type standards placed on the center line of this parkway. There is, however, a section of this boulevard south of Main Street where trolley tracks will be placed in the central parking. There the lighting standards will be installed along the sidewalk curb, for the reason that if the units were mounted on the double-bracket trolley poles in the parking, there would be an objectionable shadow on the street side of the trolley cars, especially when a car stopped to discharge or take on passengers.

BOULEVARD-TYPE STANDARDS LEND ATTRACTIVENESS TO A CENTER PARKWAY WITH SHRUBS AND FLOWER DESIGNS

The IL transformer used with these standards will have a tap which will permit the use of a 6,000-lumen (600-cp.) lamp when increased traffic in certain locations necessitates such a change.

For the secondary residential streets the same standard as that to be used for the boulevard lighting, except that it will be employed. It will be equipped with the same lighting unit and a 2,500-lumen (250-cp.) tungsten lamp. The standards will be installed at intervals of from 100 ft. to 150 ft. of street.

BOULEVARD-TYPE LIGHTING FOR DRIVES WILL BE UTILIZED

The main park drives will be equipped with lighting of the boulevard type, and minor roads and walks with standards like those used in the residential districts. Plazas, playgrounds, etc., will be considered from the standpoint of their individual needs and requirements and will be lighted accordingly. Each will be treated as a special installation.

The details of this entire plan have been approved, although its realization in the business district will require the active co-operation of the merchants located there.

When the installation is complete Lansing will have more than a modern and highly efficient lighting system. On account of the uniformity of the types of standards and lighting units selected, the general appearance of the city will be greatly enhanced. Clearly, it will be a progressive step toward the "city beautiful" and will harmonize completely with the city plan which was recently developed for Lansing. Furthermore, the plan is elastic in that it provides for the use of more powerful lamps in any of the standards as the future needs of the city may require.

The installation on Pennsylvania Avenue has been completed and is shown in the accompanying illustration. Groups of ten standards each are connected to individual 2.4-kw. type SL transformers which are fed by existing series street-lighting circuits.

DETAILS OF CABLE CONSTRUCTION AND INSTALLATION COSTS

A single conductor No. 8 B. & S. boulevard lighting cable for 600 volts service is used. The cable has $\frac{4}{64}$-in. varnished-cambric insulation surrounded by a lead sheath of $\frac{1}{64}$-in. thickness, which in turn is covered with 100-lb. jute yarn not less than $\frac{4}{64}$ in thick, thoroughly impregnated with a hot asphaltum compound. Every length of cable was tested for five minutes on an alternating electromotive force of 3,000 volts, and a 15-ft. sample of each length was subjected to a test of 6,000 volts. This is the specification for what is known as 1,250-volt cable.

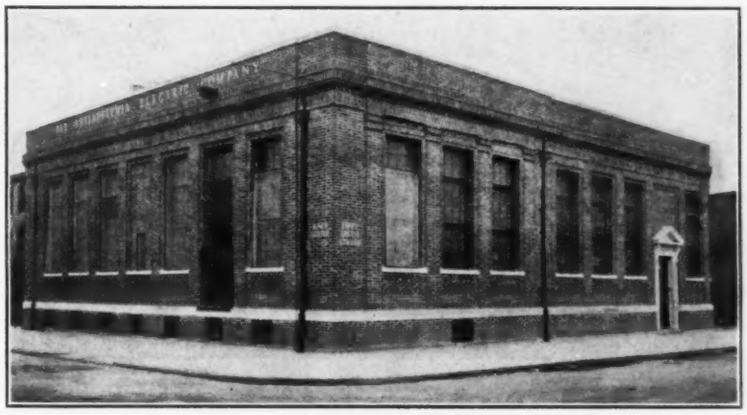
For the installation of eighty-seven of the 13-ft. standards, equipped with 400-cp. lamps, the cost for labor is $28.60, material $81, a total of $109.60 per standard. This includes the standard, lighting unit, underground cable, type SL transformer and their installation, but does not include any charge for the existing series circuits to which the SL transformers are connected or the constant-current transformers at the station. The cost is considered moderate for so excellent an installation.

Alternating-Current Substation Design

Method Adopted for Distribution at 13,200 Volts, Three-Phase, and 2,400 Volts, Two-Phase, Three-Wire—Ample Reserve Capacity and Simplicity in Layout Are Features

By R. A. HENTZ
Assistant Engineer Electric Design and Construction, the Philadelphia Electric Company

THE Philadelphia Electric Company has recently put in service two new alternating-current substations to meet the increasing load demand. One of these, known as the Race substation, supplies, along with two older substations, the load of the West Philadelphia residential district. The other substation, known as the Federal substation, supplies, together with an older substation, a combination industrial and residential load in South Philadelphia. These two new substations are very similar in their general characteristics, and a description of one would to a great extent apply to the other. Each is supplied from the generating stations at 13,200 volts, three-phase, 60-cycles, part of the energy being distributed at this voltage and the rest being transformed to 2,400 volts, two-phase, three-wire for other distribution circuits.

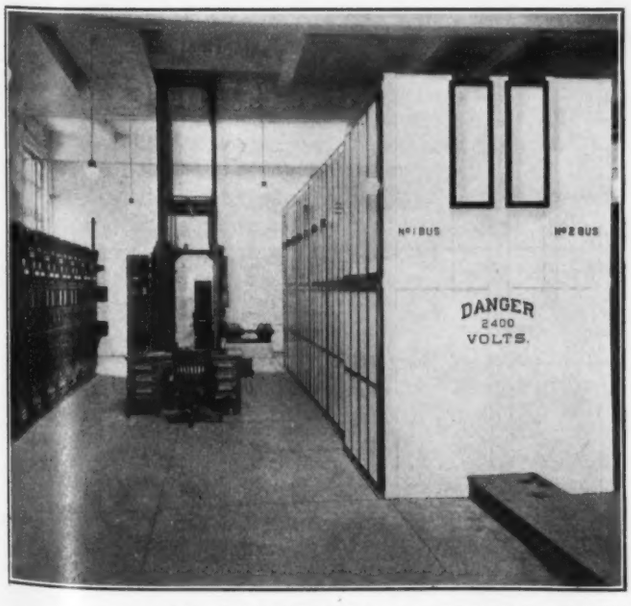


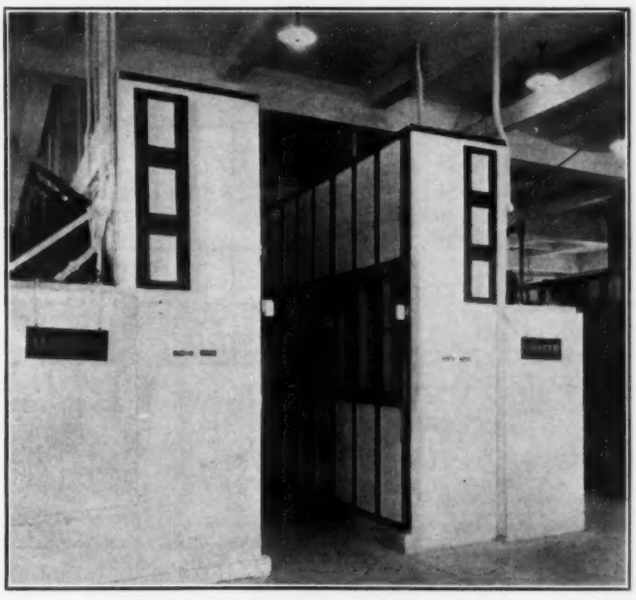
EXTERNAL APPEARANCE OF SUBSTATION HARMONIZES WITH SURROUNDING BUILDINGS

In each substation provision is made for the installation of four banks of transformers, each of 7,500 kva., two of which have been installed and supply the present load requirements. As one of these is a reserve bank, the ultimate rated station capacity is considered to be 22,500 kva. Provision is made in both of the substations for ultimately changing the distribution from 2,400 volts, two-phase, three-wire, to 2,400/4,150 volts, three-phase, four-wire, if it should ever be deemed advisable, at which time the station capacity would be increased 50 per cent by the addition of a third 3,750-kva. transformer to each bank.

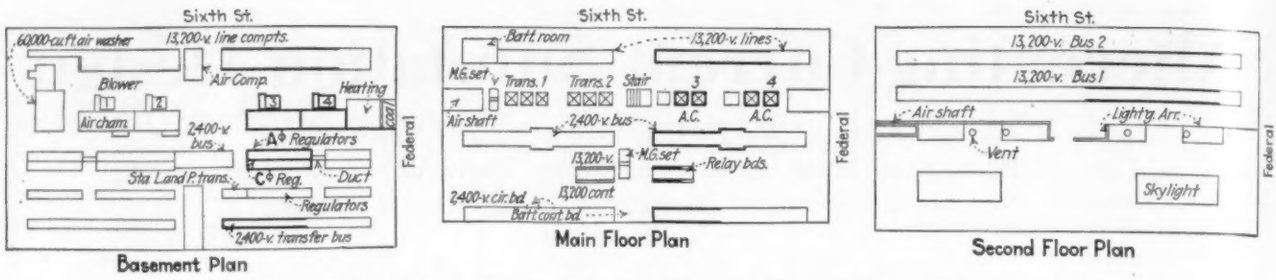
The accompanying single-line diagram and cross-sections indicate the general features of the design of this station. It will be noted that double sectionalized buses are provided on both the 13,200-volt and the 2,400-volt system, thus permitting the operation of the station in four entirely separate groups if desired. Provision is made for the installation of reactors on 13,200-volt lines, the Federal station being designed for reactors on any feeder (incoming or outgoing) as well as on the transformer banks. At the Race substation it was felt that reactors on outgoing distribution lines only would be required, and therefore such provision was made only on every third 13,200-volt section.

There are two oil circuit breakers (one for each bus) provided on each 13,200-volt circuit, switches of the

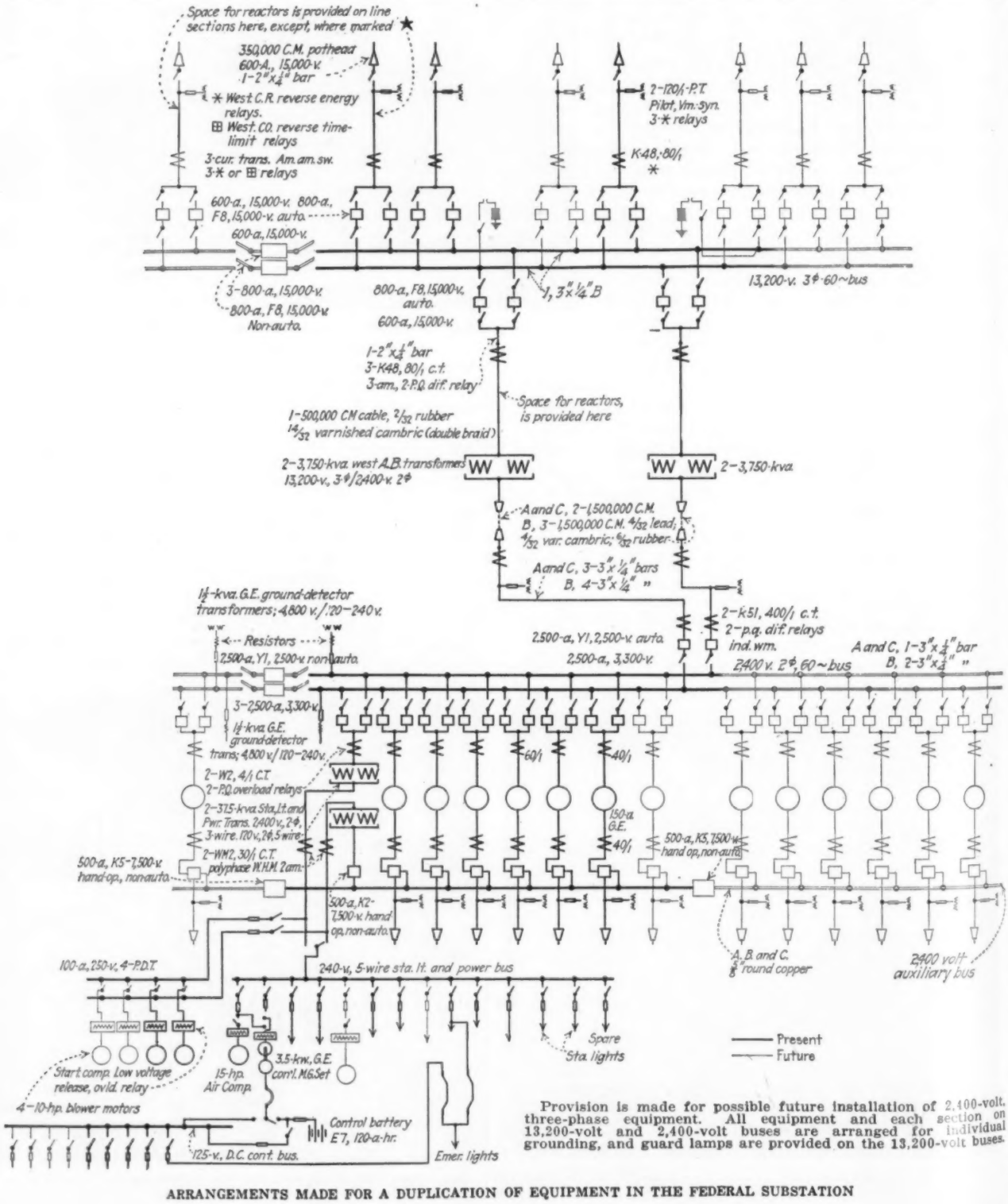




PLENTY OF CLEARANCE AND PRECAUTIONS TO PROTECT OPERATORS ARE FEATURES OF THE INSTALLATION



FLOOR PLAN OF SUBSTATION, SHOWING GENERAL ARRANGEMENTS


Space for reactors is provided on line sections here, except, where marked ★
350,000 C.M. potheads
600-A., 15,000-v.
1-2" x 1/4" bar
* West. C.R. reverse energy relays.
⊞ West. CO. reverse time-limit relays
3-cur. trans. Am. am. sw.
3-* or ⊞ relays
2-120/1 P.T. Pilot, Vm. syn.
3-* relays
K-48, 80/1
*
600-a., 15,000-v. 800-a., F8, 15,000-v. auto.
600-a., 15,000-v.
3-800-a., 15,000-v.
800-a., F8, 15,000-v. Non-auto.
800-a., F8, 15,000-v. auto.
600-a., 15,000-v.
1, 3" x 1/4" B
13,200-v. 3φ-60~bus
1-2" x 1/4" bar
3-K48, 80/1, c.t.
3-am., 2-P.Q. dif. relay
Space for reactors, is provided here
1-500,000 C.M. cable, 2/32 rubber 14/32 varnished cambric (double braid)
2-3,750-kva. west. A.B. transformers 13,200-v., 3φ/2400-v. 2φ
2-3,750-kva.
A and C, 2-1,500,000 C.M. B, 3-1,500,000 C.M. 4/32 lead; 4/32 var. cambric; 6/32 rubber.
A and C, 3-3" x 1/4" bars
B, 4-3" x 1/4" "
1½-kva. G.E. ground-detector transformers; 4,800 v./120-240 v.
Resistors
2,500-a., Y1, 2,500-v. non-auto.
3-2,500-a., 3,300-v.
2,500-a., Y1, 2,500-v. auto.
2,500-a., 3,300-v.
2-K51, 400/1 c.t.
2-p.q. dif. relays ind. wm.
2,400 v. 2φ, 60~bus
A and C, 1-3" x 1/4" bar
B, 2-3" x 1/4" "
1½-kva. G.E. ground-detector trans; 4,800 v./120-240 v.
2-W2, 4/1 C.T.
2-P.Q. overload relays
2-375-kva. Sta. lt. and Pwr. Trans. 2,400 v., 2-φ, 3-wire. 120 v., 2φ, 5-wire.
2-W2, 30/1 C.T. polyphase W.H.M. 2 am.
60/1
40/1
150-a. G.E.
40/1
500-a., K5-7,500-v. hand-op., non-auto.
500-a., K2-7,500-v. hand op., non-auto.
500-a., K3, 7500-v. hand op., non-auto.
100-a., 250-v., 4-P.D.T.
240-v., 5-wire sta. lt. and power bus
A, B and C. 2 round copper
2400 volt auxiliary bus
Spare
Sta. lights
Present
Future
Start comp. Low voltage release, ovld. relay
15-hp. Air Comp.
3.5-kw., G.E. com'l. M.G. Set
4-10-hp. blower motors
Control battery E7, 120-a.-hr.
125-v., D.C. cont. bus.
Emer. lights

Provision is made for possible future installation of 2,400-volt, three-phase equipment. All equipment and each section on 13,200-volt and 2,400-volt buses are arranged for individual grounding, and guard lamps are provided on the 13,200-volt buses.

ARRANGEMENTS MADE FOR A DUPLICATION OF EQUIPMENT IN THE FEDERAL SUBSTATION

Condit F-8 type being installed at Federal and General Electric H-203 type at Race. The incoming lines are protected by Westinghouse CR reverse energy relays and the outgoing by Westinghouse CO overload relays.

SCOTT CONNECTION USED TO OBTAIN TWO-PHASE

The transformers, which were furnished by the Westinghouse company, are Scott-connected for three-phase two-phase transformation and are protected by double-coil differential relays. In line with the practice of the company these transformers are of the air-blast type. Condit-type "Y-1" oil circuit breakers rated at 2,500 amp. are installed on the low-tension side of these transformer banks, and 500-amp. Condit "D-13-B" solenoid-operated oil-circuit breakers on the 2,400-volt distribution circuits. Provision has been made for the installation on these circuits of 250-amp. 10 per cent induction regulators. For the present units of both 150-amp. and 200-amp. are being used. Protection is afforded these circuits by instantaneous overload relays, and in the Race substation an experimental installation of circuit reclosing relays is now being tried out. It provides for the immediate reclosing of any circuit that has tripped a given number of times (probably three), after which the oil circuit breaker will remain open. If the short-circuit current at times of initial or any subsequent opening is excessive, the reclosing equipment will be rendered inoperative.

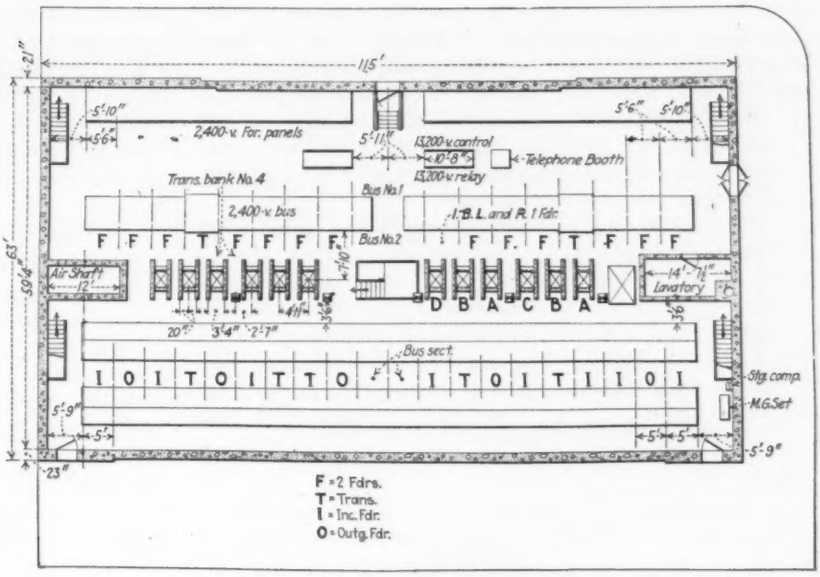
A transfer bus is provided whereby any distribution circuit can be transferred to the section supplying any other circuit in event of a failure of the oil switch or regulators of the first circuit. This transfer bus is sectionalized into four parts.

The station power and lighting supply is obtained through two 75-kva. transformer banks, one being a reserve. They supply the four motors driving the 12,000-c.f.m. Sturtevant No. 75 "Silentvane" blowers, a 100-c.f.m. Worthington air compressor, a 3½-kw. control motor-generator set, a sump pump and station lighting. The control, which is 125 volts, is supplied from the above motor-generator set which floats across a sixty-cell Electric Storage Battery Company "E-7 Exide" storage battery.

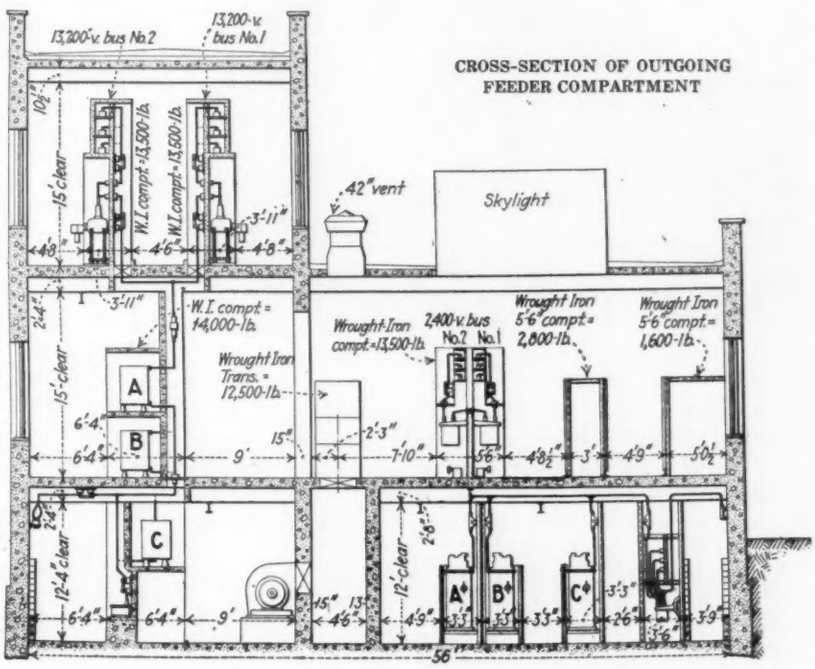
SPECIAL FEATURES OF DESIGN

Among the features incorporated in the design of both of these stations may be mentioned the following:

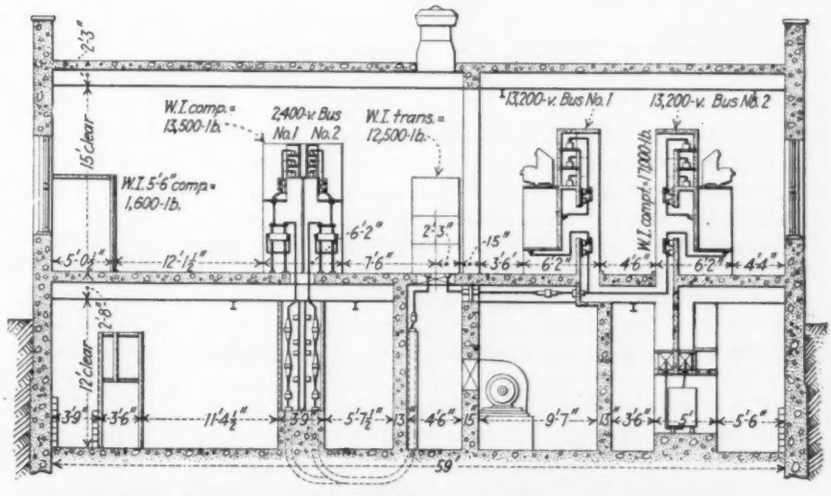
1. All 13,200-volt compartment doors



MAIN FLOOR LAYOUT WITH DIMENSIONS



CROSS-SECTION OF OUTGOING FEEDER COMPARTMENT



CROSS-SECTION OF TRANSFORMER AND SWITCH COMPARTMENT

are locked in order to make it impossible for any maintenance or construction men to get into any of these compartments without the knowledge of the station operator, who alone carries the key. When the particular compartment to be worked on has been blocked and opened, locks on all other compartments, which are exactly similar in appearance, prevent the unwary man from getting into them in error.

2. The 13,200-volt sections are provided with what are known as disconnecting switch guard lamps. These lamps, inserted in the compartment walls near the disconnecting switches, are controlled by the oil-switch mechanism and indicate by being lighted that the oil switch is open and that the disconnecting switches may be pulled, thus minimizing the chance of the operator accidentally opening a disconnecting switch under load.

3. A very effective system of marking the individual

RACE SUBSTATION WAS COMPLETED IN 104 DAYS

compartments, both 13,200-volt and 2,400-volt, is provided. This consists of small metal targets which project from the compartment barriers, indicating the line dividing one feeder section from another. The separation of circuits is further emphasized by painting broad red lines between sections.

4. Telephone drop signals are installed which indicate any occurrence that should be brought to the immediate attention of the operator, such as tripping of any transmission or distribution lines or transformers, failure of air pressure on transformers, etc. A small ball which normally shows a black face rotates so as to show a red one, at the same time ringing a distinctive bell which cannot be confused with the door or telephone bells.

5. All 13,200-volt and 2,400-volt lines enter and leave the stations underground, and where the circuits are aërial connections are made to the lines at nearby terminal poles. The ducts inside of the substation are flexibly arranged so that cable in any one of them can be brought to any compartment.

6. In order to facilitate the work of the underground department in installing new cables or repairing damaged ones, arrangements are made so that any of the three leads from the pothead can be very easily connected to either of the three jumpers which extend to the oil switches and bus, thus allowing the underground department to make its cables splices in the best possible way, irrespective of phases, the cables being finally phased out in the substation where the correct connections are made.

7. The psychology and economy of a bright, cheerful station is recognized in the design, and ample windows and skylights flood the entire station with daylight. The walls (above a man's height) and ceiling are painted dead-white.

FUTURE EXPANSION MADE POSSIBLE

It may be of interest to note that work was started at the Federal substation by the demolition of an old church building on June 5 and the station finally put in operation on Oct. 22—118 working days being consumed from time of starting to completion. At the Race substation, which is slightly smaller on account of the fewer number of reactors provided for on 13,200-volt lines, work was started on June 26 and the station put in service Oct. 29—104 working days being consumed. As can be seen from the photographs, these stations are of a pleasing appearance and constitute a desirable addition to the neighborhood.

In both cases only about one-half of the ultimate building was erected, which allows for the installation of seven 13,200-volt lines, two transformer banks and fourteen 2,400-volt distribution circuits. These sections will care for the load served for a few years to come, thus postponing a heavier investment in building until such time as it is actually required.

Bureau of Mines Cites Advantages of Electric Brass Melting

THE theoretical advantages of electric brass melting are summarized by the United States Bureau of Mines in one of its recent publications as follows:

1. Melting may take place in a neutral or reducing atmosphere, thus minimizing loss of metal by oxidation and improving the quality of the product through freedom from oxides.

2. Metal of crucible quality may be obtained without the use of crucibles.

3. Melting may take place in a tightly closed chamber, or at least in one free from the constant passage of the products of combustion of fuel, and thus losses of volatile metals such as zinc and lead may be reduced. Contamination by sulphur from fuel is avoided and a better product obtained.

4. In some types of electric furnaces the temperature may be more readily controlled than in fuel-fired furnaces.

5. In some types of furnaces the molten metal is thoroughly stirred, thus giving a uniform product, even with large heats.

6. There is no handling or storage of fuel, such as coke, coal or oil, and no ashes have to be removed. The cost of power can be accurately predicted over longer periods than the cost of fuel.

7. Working conditions about the furnaces are less dangerous to health and safety of workmen, provided that suitable types of furnaces are chosen.

8. The above advantages may be obtained in furnaces of larger capacity than can be used satisfactorily in the fuel-fired crucible types, with resulting greater uniformity of product, lower labor cost and increased production.

How 2,214 Old Houses Were Wired

Preliminary Survey of Territory — Formulation of Sales Plan — Organization of Employees Into Selling Force — Total Cost of Six Weeks' Intensive House-Wiring Campaign

By RALPH G. WEBBER
Central Maine Power Company, Augusta, Me.

IN A TERRITORY such as that served by the Central Maine Power Company, comprising more than 140 cities, towns and municipalities scattered over an area of several hundred square miles, there are bound to be a good many unwired houses along the lines. Last year it was decided to put on a campaign to connect these houses to the lines at the least possible selling cost and without making a heavy investment in extensions.

The company had no definite records of these unwired houses, and to see what sort of campaign could be worked out a survey was first made. The superintendent of each of the company's twelve districts was asked to make a close estimate of the number of unwired homes in his territory which could be reached by a service loop or by setting one pole. By riding around the streets and roads and in some cases making estimates it was learned that there were more than seven thousand unwired homes right along our distribution lines which were without electric service. What a splendid field for more and better business! Here were our logical customers burning odorous oil lamps right under our noses.

THE PLAN OF ATTACK

With this information it didn't take us long to decide that the main attack of our advertising plan would be "direct by mail." Inasmuch as the superintendents had proved to their own satisfaction that they had a lot of unwired homes in their fields, it was a fairly reasonable request to ask them to furnish the head office with the names of the occupants of these homes. Blank "prospect" cards were sent to every superintendent with the request to furnish the name of the occupant of each unwired house and to state whether he or she was the owner; also, the street and number of the house and whether the house could be served with a service loop or by setting one pole.

While this information was being gathered, we formulated the sales plan, devising ways to put our offers before the "prospects" and the most practical way to reach them by personal salesmanship.

In order to give a visual example of what could be bought for certain prices, four popular-priced combinations were made up to be installed by the company's own crews of inside wiremen. They were listed as follows:

1. *Combination at* $15.—Flatiron outlet and ceiling outlet for kitchen; entrance, ground and complete installation ready to use. Easy terms of $5 a month.
2. *Combination at* $25.—Three fixtures, one each for the kitchen, dining room and sitting room, to be installed on one floor; all complete, ready to turn on the lights. Terms, $5 down, $5 a month.
3. *Combination at* $33.75.—Single drop lights for kitchen and hall; two-light fixtures for dining room and sitting room. Terms, $8.75 down, $5 a month.
4. *Combination at* $50.—Drop lights for kitchen, hall and two upstairs bedrooms; two-light fixtures for living room and dining room; complete equipment ready to use. Terms, $10 down and $5 a month.

These four combination offers were illustrated and described on a four-page folder (5½ in. x 8½ in.) folded twice to go into a standard No. 5 government envelope.

To drive home the message of electrifying the home, two series of three letters each were written. One series was worded for the home owner, the other for the renter. As the prospect cards carried information as to whether the occupant owned or rented the house, it was an easy matter to separate the cards and have the correct series mailed to each class of occupant. The home-owner series of three letters all emphasized the advantages of electricity, the low prices and the popular combinations.

The first letter was addressed to the woman of the house, the second to the head of the family, while the third did not particularize. With each letter a booklet or folder was inclosed. With the first letter a folder illustrating various electric appliance needs was inclosed. with the second the booklet "Electricity in Your Home" (issued by the N. E. L. A.), and with the third went the folder illustrating and describing the special offers. The series attempted to present a climax in buying appeal. The appliance folder portrayed the "by-advantages" of electricity in the home; the N. E. L. A. booklet showed the elegance, luxury and convenience of the home electric, and the third brought it "down to cases" and showed just how any family that could spare from $15 to $50 could have electricity.

To drive home the sales message with sledgehammer force the three letters were mailed out at intervals of every other day—the entire series in six days. Three letters on the same subject, from the same company, it was thought, ought to be enough to force favorable attention. They were. With the first and last letters in the series a return post card was inclosed which asked a representative of the company to call.

RENTERS PRESENT A DIFFERENT PROBLEM

In approaching the occupant of a rented house the sales problem was entirely different from that encountered in soliciting business from the occupant who owns his home. The landlord in Maine apparently figures on doing just as little as he can in the way of repairs or betterments and charging as much rent as the tenant can bear. The tenant appreciates the situation and is reluctant to approach his landlord, well knowing that $50 worth of improvement may mean a $5 raise in the monthly rent.

The series of letters aimed at this class of prospects was written with the idea of bringing the renter and owners together on some sort of a working basis. With the owner the point was made that vacant houses were

becoming more numerous and that the owner of improved property would be able to get first choice of tenants. One of these letters is reproduced.

(Form Letter Addressed to Landlords)

Isn't It Worth While to Keep Your Property "Up"?

Have you noticed the general tendency toward increased building activity?

The opinion seems to be gaining ground that instead of a housing shortage we shall soon be facing a housing surplus.

Roger Babson, the famous business observer, feels that there is now a pronounced drift toward an oversupply of new "rents."

Under such changed conditions won't old and unimproved dwellings be hard to rent? Won't tenants be more apt to pick the improved buildings?

Shrewd landlords are apparently anticipating these conditions by improving old dwelling places so that they can compete with the new ones.

Electric service is one of the first improvements installed. Nothing else can add a like comfort to the home. One of the first questions that home renters ask is: "Has the house electric lights?" Electric service means not only lights but electric irons, fans, appliances for cooking and vacuum cleaners.

To the tenant these electric comforts mean satisfaction, convenience, a pride in the home and a willingness to pay the rent cheerfully.

To the landlord "electrified rents" mean improvement of property, keeping the property on a par with that of other "rents" that do have all such conveniences, a greater ease in renting, and the opportunity to ask a greater rental.

During the next few weeks you will have an opportunity to wire your property at special low prices—the lowest prices since 1916 or 1917.

If you wire up now, you will increase the value of your property and make your tenants too comfortable to think of moving.

The inclosed postcard will bring a representative to explain the special wiring proposition that we are now making.

CENTRAL MAINE POWER COMPANY,
GEORGE S. WILLIAMS,
General Superintendent.

GENERAL ADVERTISING

Although it was fully realized that newspaper advertising would shoot wide of the mark, it was thought best to tie in the direct mail campaign with general publicity. Accordingly, when the campaign opened, the fifteen-dollar combination offer was featured in the papers throughout the territory. Near the close of the campaign one other advertisement was used to remind prospects that they had only a few days more in which to take advantage of the cut in prices. In addition every window of our thirty-two stores in some way carried the message to electrify. All our motor trucks throughout the territory carried banners with appropriate slogans.

The fundamental secret in achieving success in the campaign lay not in the series of letters, not in the popular-priced offers, nor yet in any magic of the printed word, but in real "honest-to-goodness," face-to-face salesmanship. Left to their own fate, the letters would have made but a slight impression on the persons in the seven thousand unwired homes. Of the post cards inclosed with the letters only about 1 per cent were returned. No organized sales force was in operation, districts were widely scattered, employees knew little or nothing of the company plans. So, to make the publicity really forceful, a campaign of education had to be carried out among the employees themselves. Employees had to be "sold" on the campaign just as thoroughly as the prospects. To do this the company took every employee into its confidence, told exactly what the plans were and how it expected to proceed to achieve results.

First in the series of publicity matter directed toward the employees was an issue of the company house magazine, *The Exciter*, which was devoted almost entirely to an explanation of the campaign. In a straightforward story we told the employee that his success and that of the company were one and inseparable. We pointed out that his bread and ours were buttered on the same side. The machinery of the campaign was explained and a simple sales talk on house wiring was published.

By the time the issue of *The Exciter* was in the hands of the employees a series of district meetings was started. The superintendent of each district was asked by the general superintendent to assemble his metermen, inside wiremen, clerks and all others who could be spared for soliciting to listen to an explanation of the plan. At the district meetings the series of prospect letters was shown to the employees. The function of each letter was explained, as was the ease with which a sales talk could be made.

As part of every combination offer of $25 and more a free flatiron was included. The gift of the iron was reserved for the salesman to make. If, after the regular sales talk had been made there was any hesitancy to sign the contract, the salesman was instructed to say:

"Mrs. Jones, if you will take this combination now, I am authorized to make you a present of a regular 'six-seventy-five' flatiron." It proved to be a good "clincher" for the sale.

In a great many cases the contract could be closed without resorting to the offer of the iron. In such cases the flatiron was included as a gift of appreciation "in order that the new customer might more quickly learn some of the advantages of having electricity in the home."

QUOTAS PROMOTE DISTRICT PRIDE

In order to get a fair basis of comparison of the work done by the different districts the number of unwired homes, as previously determined by the superintendents, was set up as a quota or bogey. Each district in this way was put on as near an equal footing as an accurate count of unwired homes could make it.

Pride of district in most companies is as potent a stimulus to sales as pride of country is to patriotic effort. And nothing stimulates sales effort more than a few prizes. As a final incentive to action, three prizes were offered—$50, $30 and $20—for the three districts which should score in one-two-three order in percentage of quota sold. Fifty dollars was also put up for reward of individual selling records.

When the series of letters had been mailed to prospects and when all the employees had received their instructions real action began. A telegram or telephone message was sent to every superintendent to start his work of solicitation. Every district started at scratch on a given date.

The campaign was scheduled to continue for a month. The big problem was to see people as fast as the letters were mailed. Speed was urged and in part maintained by frequent bulletins, telephone messages and telegrams to all districts showing the progress of the campaign.

The standing of each district was figured, and at times various sales suggestions were incorporated in the bulletins. Interest and enthusiasm were thus kept at a high pitch.

It would not be true, however, to say that every district jumped into a run at the start. On account of lack of solicitors some districts lagged behind. Help was sent to these districts in the form of a flying wedge of salesmen. Ex-wiring solicitors and salespeople recruited from other departments were routed from district to district, as the need required, to stimulate and help the campaign.

At the end of four weeks the campaign had netted 1,200 contracts and showed no signs of diminution. The time was accordingly extended two weeks, by the end of which a total of 2,214 contracts had been obtained. This represented sales of 34.9 per cent of the possible estimated business. The district selling the greatest percentage of its quota reached 66.6.

At the close of the campaign the company had nearly two thousand contracts on its books. This condition presented still another sales problem. No matter how long a person had lived without electricity, as soon as he had decided to buy he wanted the lights instantly.

In order to hold the business a letter was sent about a month after the close of the campaign to customers whose wiring would be delayed. In this letter it was explained that the company's offer had been so popular that wiring crews were swamped with work. As a result of this letter and with a little explanation on the part of the local superintendent not a contract was canceled.

In giving 2,214 as the total number of contracts obtained it is only fair to say that in it is included the ordinary growth that would come without extra solicitation, as well as a few contracts brought in by contractor-dealers.

CAMPAIGN COST ABOUT $1,800

The cost of advertising, soliciting, prizes and all other expenditures of the campaign was less than $1,800. The contracts for wiring which the company executed brought in gross business of $80,000 and put an added load on the company lines that will bring in an annual revenue of not less than $25,000. In passing it might be noted that most customers selected the fifty-dollar combination plus additions which would average $60 or more.

In the plan of campaign as outlined here there is nothing that any central-station company with a number of unwired houses along its lines ought not to be able to do with good results. Every company has meter readers, stock clerks, wiring solicitors and stenographers. They can be made into an efficient sales force, if it is made easy for them to sell, by offering attractive prices, and by paving their way with advance advertising matter. About all that was new in the Central Maine campaign was the application of old ideas to a new selling plan. Intensive use of the mails, low-priced combination offers, personal selling under a quota basis, easy time payments and the free gift of a flatiron were the outstanding points.

December Output Over 5,000,000,000 Kw.-Hr.

Total Gross Revenue from Sale of Energy During Last Month of 1922 Was $107,600,000, an Increase of 6 per Cent for Twelve-Month Period

REPORTS received by the ELECTRICAL WORLD for the month of December from central generating and distributing companies representing 77 per cent of the installed generator rating of the country indicate that four new records were established by the industry during the month. The total sales of energy during the month was 5,200,000,000 kw.-hr., which exceeded the former high monthly figure, set during November, by 5.4 per cent. In addition, the average daily output was 167,958,000 kw.-hr., which exceeded the previous record, also made during November, by 4,738,000 kw.-hr. The second set of record figures reported by the industry for the month of December is to be found in the revenue received from the sale of energy. The total gross revenue from the sale of energy was $107,600,000, which exceeded the former high monthly revenue, reported during November, by 6.3 per cent. Moreover, the average daily revenue from the sale of energy during the month was $3,474,000, which exceeded the former record, made during November, by $101,000.

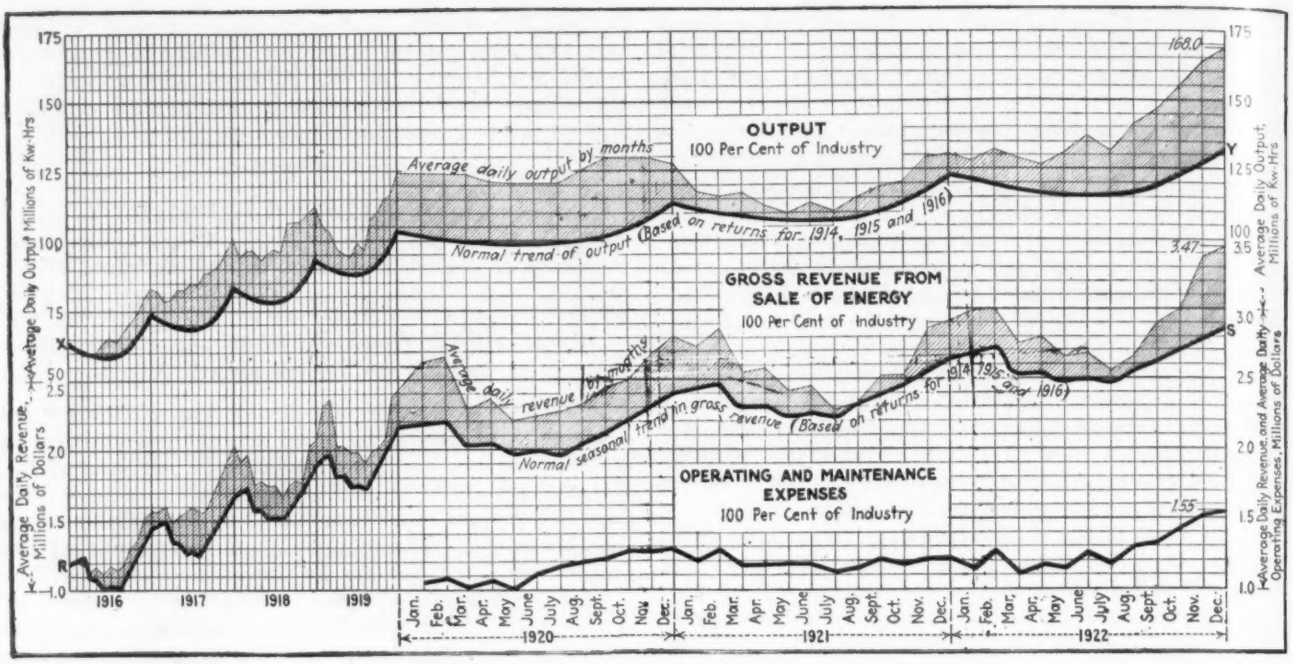
It must be remembered in studying these data on central-station output that they do not represent the actual amount of energy consumed during December, but the amount of energy actually sold by various distributing companies, some of which was sold to other public utilities for resale and so is counted twice in the resulting tabulation. Similarly, the gross income does not represent the amount paid to the central-station companies by the actual consumers of electrical energy generated during the month, but includes also payments made by one public utility to another public utility for energy which was in turn resold to the actual consumer. Both these transactions are necessarily included in the ELECTRICAL WORLD tabulation as representing the actual operations within the industry.

Expressing the financial phase of the returns in terms of the operating ratio, or ratio of operating expenses to gross revenue from sale of energy, shows that the net earnings per dollar spent for operation and maintenance were less than reported for December, 1921. The operating ratio reported for December, 1922, by companies having steam plants only, taken in the aggregate, was 49.3 per cent, against 48.3 per cent for De-

TABLE I—CENTRAL STATION RETURNS FOR THREE MONTHS

Mos.	Percentage of Installed Ratings Represented	Kw.-Hr. Output (Companies Reporting) 1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	Revenue from the Sale of Energy (Companies Reporting) 1922 Thousands	1921 Thousands	Per Cent Increase
Oct...	82	3,922,493	3,171,675	23.6	76	$70,710	$61,024	15.8
Nov..	81	3,966,256	3,211,271	23.5	75	75,911	65,197	16.3
Dec..	77	4,009,216	3,202,470	25.2	71	76,489	65,900	16.0

Mos.	Percentage of Installed Ratings Represented	Operating and Maintenance Expenses (Companies reporting) 1922 Thousands of Dollars	1921 Thousands of Dollars	Per Cent Increase	OPERATING RATIO Steam Plants 1922	1921	Hydro Plants 1922	1921	Combined Systems of Steam and Hydro 1922	1921
Oct...	62	27,781	23,260	19.5	52.1	51.1	28.9	27.8	48.8	47.7
Nov..	62	28,304	26,069	8.6	50.4	50.2	24.3	25.0	46.0	45.2
Dec..	59	28,316	23,577	20.2	49.3	48.3	29.7	27.7	48.8	46.1


OUTPUT
100 Per Cent of Industry
Average daily output by months
Normal trend of output (Based on returns for 1914, 1915 and 1916)
GROSS REVENUE FROM SALE OF ENERGY
100 Per Cent of Industry
Average daily revenue by months
Normal seasonal trend in gross revenue (Based on returns for 1914, 1915 and 1916)
OPERATING AND MAINTENANCE EXPENSES
100 Per Cent of Industry
Average Daily Output Millions of Kw-Hrs
Average Daily Revenue Millions of Dollars
Average Daily Revenue and Average Daily Operating Expenses, Millions of Dollars
Average Daily Output, Millions of Kw-Hrs
168.0
3.47
1.55
1916
1917
1918
1919
1920
1921
1922

cember, 1921. This increase is undoubtedly due in large measure to the higher cost of coal this winter than last winter. Although in July, 1922, the operating ratio for the same companies was 55.3 per cent and in August was 56.6 per cent, such a decrease in operating ratio between winter and summer months is to be expected on account of the relatively higher percentage of low-revenue industrial energy sold during the summer months.

Every section of the country except the South Central States reported energy consumption over that of November. In New England the cotton mills reported a record number of active spindles, calling for increased energy consumption. The Atlantic Section reported by far the largest increased energy consumption over November. This was probably a reflection of the continued growth in pig-iron production, which during December was almost double the production reported for December, 1921. A high degree of activity in the Southern cotton mills also added to the energy consumption of the Atlantic section. Energy demand in the North Central section appears to have been almost the same as during November, despite the advancing season and consequent increased lighting requirements.

Great Susceptibility to Electric Shock in Panama

ONE of the peculiarities of Panama is the deadliness of electricity in that region. Voltages of 110 to 220 in former days repeatedly caused fatal accidents. Since construction days on the canal the Government has provided ample safety appliances, and few deaths now occur notwithstanding that all operating equipment on the canal except the Panama Railroad is electrically driven.

The reason for the abnormal susceptibility to shock, explains R. Z. Kirkpatrick, president of the Engineers' Club of the Canal Zone, is probably climatic. Almost daily precipitation keeps shoe soles moist and standing places are likely to be damp. Again, the temperature and humidity of the air are such that perspiration is almost constant, giving an excellent chance for the full transmission of current on contact. Another point is that physical vitality is lower in the tropics and electric shock is therefore more easily effective in stopping the action of the heart.

In four cases of electrocution Mr. Kirkpatrick personally saw in the Canal Zone, with no voltages above 500, prompt efforts at resuscitation failed.

TABLE II—CENTRAL-STATION RETURNS BY SECTIONS OVER A THREE-MONTH PERIOD

Month	New England States				Atlantic States				North Central States				South Central States				Pacific and Mountain States		
	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase	Percentage of Installed Ratings Represented	1922 Thousands	1921 Thousands	Per Cent Increase
KW.-HR. OUTPUT:																			
Oct.	80	297,362	251,833	14.1	80	1,408,629	1,128,973	24.8	82	1,305,808	1,058,870	23.4	64	201,756	160,261	25.8	97	706,346	571,738	23.5
Nov.	78	312,988	248,457	26.0	78	1,440,751	1,163,312	23.8	81	1,318,588	1,073,114	23.6	64	212,739	159,917	33.1	97	681,190	566,471	20.2
Dec.	80	337,890	255,177	32.4	76	1,510,678	1,217,027	24.2	74	1,249,161	993,377	25.7	62	208,452	163,828	26.2	93	703,035	573,061	22.6
REVENUE:																			
Oct.	80	$7,055	$6,370	10.7	74	$26,361	$22,453	17.4	69	$22,130	$18,716	18.3	64	$4,652	$4,136	12.5	97	$10,512	$9,319	12.8
Nov.	78	7,757	6,878	12.8	73	28,577	24,359	17.3	69	23,659	20,037	18.2	62	5,022	4,330	16.0	96	10,896	9,593	13.6
Dec.	80	8,429	7,089	19.0	71	29,483	25,922	13.7	62	22,166	18,495	19.9	61	5,096	4,407	15.6	93	11,315	9,987	13.3
OPERATING EXPENSES:																			
Oct.	52	$2,387	$2,023	17.9	55	$9,209	$7,695	19.7	54	$10,608	$8,567	23.8	63	$2,397	$2,096	14.4	95	$3,703	$3,412	8.5
Nov.	52	2,545	2,161	17.7	54	8,942	7,804	14.5	57	10,540	8,468	24.4	62	2,597	2,178	19.3	94	3,680	3,537	4.1
Dec.	51	2,785	2,005	38.9	53	9,458	8,116	16.3	51	9,447	7,388	27.7	61	2,592	2,170	20.8	92	4,034	3,898	3.5

Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

National Aspects of Niagara Falls Developments

To the Editors of the ELECTRICAL WORLD:

It is a fortunate thing that the complexity of electrical engineering problems is so generally recognized that there is little danger of the disastrous results which would ensue were those who had not given the subject sufficient study to undertake their solution. It is unfortunate that the far greater complexity of the problems of economics and sociology is generally ignored. This tendency is well illustrated in an otherwise able article by Frank G. Baum in the ELECTRICAL WORLD of Jan. 27, 1923, by the following extracts:

"To attempt to find a local demand for the whole of these large [hydro-electric] powers, as was done at Niagara, . . . is uneconomic and unsound for the industry and from a standpoint of national stability. For to be stable we should have the industries of the country diversified and spread out over the country as much as possible, building up the smaller communities as well as the large centers. At present places like Niagara . . . have much cheaper power than obtains in the smaller cities and towns. This does not make for a healthy growth of the states and nation. We need a transmission system which will take the power from the large producing centers and more nearly equalize power conditions in small and large cities. . . . It is not sound practice to allow all the water powers of Niagara to be used locally to the advantage of a few industries, but part of the power should be required to flow out into the smaller cities to help them prosper. . . . In that way we will spread out the advantages of water power among more people, and this will in turn create a more favorable opinion for the logical development of water power and transmission systems to meet the needs of the states and the nation."

Passing over the rather absurd implication that there are no transmission lines in the Niagara district and without attempting to analyze Mr. Baum's solution of the complex economic and sociological problems involved in the use of hydro-electric power, it may be worth while to point out a few elementary facts which must be considered before even an approximation of the true solution is arrived at.

Starting with the assumption that it is desired to "spread out the advantages of water power" as widely as possible among the people, the problem is: How can this be done? A superficial view might lead to the solution offered by Mr. Baum—the building of transmission lines which will distribute the hydro-electric power over as large an area as possible. But the recognition of the complexity of a problem of this kind should serve as a warning that a superficial study will not yield the true solution. Now, while it may be perfectly true that the solution of the problem found by the Pacific Gas & Electric system in California is a good one, it does not follow that a different solution at Niagara Falls is a bad one, because the conditions are by no means the same in the two places. Indeed, a study of the results shows that the Niagara Falls hydro-electric development has been more successful in finding a way to spread out the advantages of water power than has the system in California. This does not by any means mean that the Californian development is subject to adverse criticism, because the more widespread distribution of the benefits which can be derived from Niagara Falls is due in great part to geographical conditions. While a large proportion of the water power of Niagara—not by any means all, as Mr. Baum implies—is used locally in the form of electrical energy, the ultimate advantages of this use are spread all over the United States, and indeed the world, and are not confined, as the superficial investigator might suppose, to a few industries.

The mischief is that many farmers, dwellers in small towns and villages, and even some electrical engineers, cannot see how the energy of Niagara Falls can be made to benefit the people except by an electrical transmission line. These critics do not complain of the concentration of the blast furnaces about the great coal fields of the United States, they do not deplore the use of coal by the blast furnace as an unsound practice followed for the advantage of a few local industries. They realize that it would be the height of folly to insist on the distribution of the coal over the country so that every village and small town could run its own blast furnace, for they know that it is to the advantage of the whole country that iron and steel should be produced where they can be manufactured most economically. But our critics do not realize that the country needs ferro-alloys, abrasives, fertilizers, chlorine and the hundreds of derivatives of electrochemical and electrometallurgical industry which cannot possibly be manufactured as cheaply as they are now unless they are near the source of a great hydro-electric plant, and that this in turn must be within economical distance of the places where the products are used. In other words, they are unable to see any method of distributing the advantages of a water power like Niagara Falls except by means of a 220,000-volt transmission line. Yet when the fruit grower of California is destroying insect pests, which otherwise would ruin his crops, with cyanide; when the cotton grower is fertilizing his fields with cyanamide; when the health statistician files his figures showing the enormous decrease in typhoid fever throughout the United States or in the Panama Canal district due to the use of chlorine in purifying drinking water; when the farmers in all our great farm lands drive their tractors and the passengers travel in coaches running on rails, drawn by locomotives, all built in great part of steel manufactured with ferro-alloys and fashioned with artificial abrasives; when the miners going down into the mines, and thousands of families in isolated places where there is no gas and no electricity, light their acetylene lamps—they are realizing consciously or unconsciously the advantages of Niagara Falls.

It would be impossible in a short space to consider even briefly the economic and sociological reasons which fully justify the large use of hydro-electric powers like that of Niagara for electrochemical and electrometallurgical industries and to show that this use does not involve fostering a few favored manufacturers at the expense of the states and the nation; but this brief note may at least do something toward arresting dangerous misconceptions which are apt to be formed in the minds of the people by a careless *obiter dictum*.

Niagara Falls, N. Y. FRANCIS A. J. FITZGERALD.

Central Station and Industrial Practice

Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

Economy in Furnace Wall Construction

MODERN boiler-room practice imposes duties on furnace walls and linings that were formerly considered impracticable. Consequently the quality and manner of installing these linings is receiving well-merited attention. The purchase of high-grade refractories is a good investment, but the conditions under which different parts of the furnace will operate should be studied.

For example, a survey of the interior of a furnace in active operation, which may readily be made with the aid of an optical pyrometer, will disclose certain "hot spots" that explain why some grades of firebrick do not stand up well under service. One such survey recently made on a furnace disclosed a temperature in excess of 3,000 deg. F. over a horizontal zone, about in the center of the side walls of the combustion chamber and the rear bridge wall under the mud drum of a Stirling boiler. The temperatures shaded off to about 2,400 deg. on either side above and below this point. Other parts of the same furnace at the same time were operating at temperatures below 1,800 deg. This furnace will be relined with at least two grades and possibly three grades of firebrick.

Considerable trouble is sometimes experienced with chipping or spalling. This may be caused by unequal expansion of the brick, especially in stand-by steam plants on a hydro-electric system where rapid changes of temperature due to sudden changes in load are encountered. The writer has had experience with a number of Dutch-oven furnaces in the steam stand-by plants of the Portland Railway, Light & Power Company, where sawmill refuse is burned. In these large flat-arch tiles are hung. These tiles were laid about ¼ in. apart with high-temperature cement between them, but only in the outer half of the joint, the inner half next to the fire being left open. Since the inner face of the tile was subjected to more rapid changes in temperature, it expanded and contracted more rapidly than the outer portion. The open joint permitted this expansion to take place freely, with the result that after two years' use under the most extreme conditions of stand-by service only one tile has lost its edge, and this was caused by the careless handling of a firing tool. The accompanying halftone shows the appearance of this arch when first installed and indicates quite clearly the open joints between the faces of the tile.

Another detail in connection with this arch construction has resulted in lower maintenance costs. The main I-beams holding up the arch extend beyond the brick side walls and are supported by steel channel columns erected against the outside furnace walls. These channels bear the entire weight of the arch, relieving the outside walls from any stresses except those due to their own weight. The two years' service from these furnaces have shown the side walls to be in a much better state of preservation than is the case with furnaces where the side walls carry the entire weight of the arch. This form of construction also permits any part of the side walls to be removed for repairs without disturbing or shoring up the arches.

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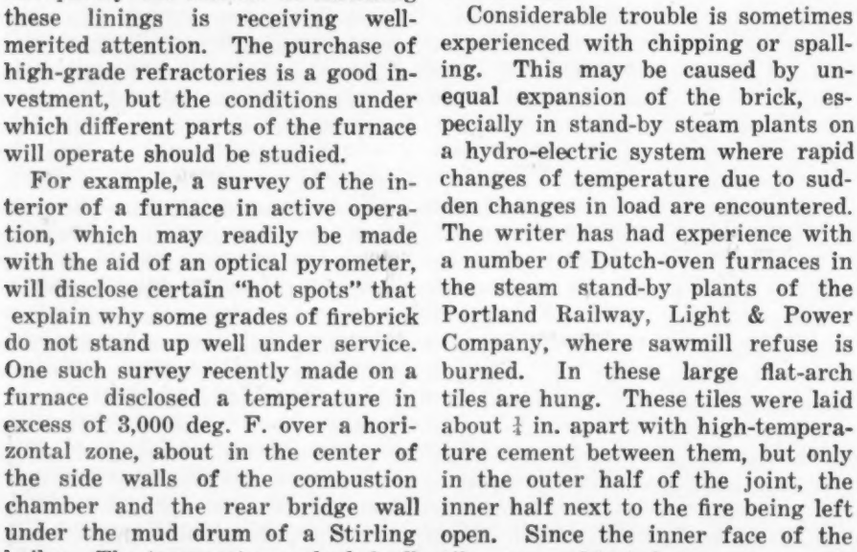

CHIPPING AND SPALLING OF FURNACE BRICKS PREVENTED BY LEAVING ¼-IN. OPENING BETWEEN FACE OF BRICKS IN FURNACE ARCH

Motors and Appliances in Dusty Places

SEVERAL important revisions of clauses in the National Electrical Code relating to the protection of motors and appliances in dusty locations have been recommended by the electrical committee of the National Fire Protection Association. These proposed changes after final revision are to be incorporated in the 1923 edition of the code and are given in part below:

Rule 8 (f), amend to read:

"Motors having brushes or sliding contacts exposed to combustible dust must be placed in separate dust-tight rooms, or non-combustible housing pro-

vided with effective ventilation from a source of clean air.

"In places where combustible dust is thrown into suspension in the air in sufficient quantity to produce explosive mixtures, such as in flour mills, grain elevators, etc., or where it is impracticable to prevent dust or flying materials collecting in dangerous quantities on or in motors, all motors shall be either of the totally inclosed type or shall be placed in separate dust-tight rooms or non-combustible housings. Such rooms or housings shall be effectively ventilated from a source of clean air."

Rule 31 (a), amend to read:

"In places where combustible dust is thrown into suspension in the air in sufficient quantities to produce explosive mixtures, dust-tight fixtures inclosing lamps and sockets shall be used. Such fixtures should be supported by conduit hangers or chains to prevent any strain on the wires. Wires should have rubber insulation not less than $\frac{3}{64}$ in. thick."

Rule 25 (a), paragraph to be added:

"Electric heaters shall be so located that dust or flying material will not collect on them in dangerous quantities."

FIELD EDITOR ELECTRICAL WORLD.
New York, N. Y.

Extracts from Operating Code

BY FIELD EDITOR ELECTRICAL WORLD
New York, N. Y.

Automatic Voltage Regulation for Generators

THE type KR system of automatic voltage regulation employs a booster which can be inserted in the circuit between the generator field and the individual exciter or the excitation bus. The field of this booster is supplied from a booster exciter, whose field in turn can be varied automatically not only in strength but in direction, having a continuous range from a maximum positive to a maximum negative value.

The booster-exciter voltage, and consequently the booster voltage, will vary in accordance with the strength and direction of current in the booster-exciter field; and the booster voltage will either buck or boost the excitation voltage and so give double the range of regulation for the same capacity of regulating machine. By means of a Tirrill regulator the alternating-current coil of which is connected to the bus whose voltage is to be regulated, together with suitable resistors and other auxiliary apparatus, the booster-exciter field current is varied in such a manner that the proper boost or buck is applied to the generator field circuit to maintain the desired bus voltage.

When it is desired to change from automatic to non-automatic regulation on a generator equipped with this system, it is essential to close the booster short-circuit breaker before opening the booster circuit breaker to prevent opening the generator field circuit. Below are given the directions for starting a booster, changing from one booster to another, changing regulators and taking a booster out of service, as outlined in the operating code prepared by the Philadelphia Electric Company:

STARTING A BOOSTER TO OPERATE ALONE

1. Start the booster motor-generator.
2. Start the booster-exciter motor-generator.
3. Close the booster circuit breakers.
4. Open the booster short-circuit circuit breaker.
5. Close the double throw alternating-current potential switch to the bus whose voltage is to be regulated.
6. Select, by means of the direct-current potential plug, the booster which is to supply direct-current potential for the regulators.
7. See that the switch marked "differential relay" is closed.
8. Examine the regulator and see that all the switches connecting the booster exciter field, selected in No. 6, to the regulator are closed.
9. Close selector switch of regulator.
10. Close the field switch of the booster exciter.

STARTING A BOOSTER AFTER ONE OR MORE ARE IN OPERATION

1. Start the booster motor-generator.
2. Start the booster-exciter motor-generator.
3. Close the booster circuit breakers.
4. Open the booster short-circuit circuit breaker.
5. Examine the regulator and see that the switches connecting the incoming booster to the regulator are closed.
6. Close the field switch of the booster being put into operation.
7. If necessary, make a slight adjustment in the value of the R-3 resistance to permit satisfactory parallel operation.

CHANGING FROM ONE BOOSTER TO ANOTHER

1. Open the field switches of all booster exciters in service, opening last the switch of the booster to which the direct-current potential plug has been connected.
2. Change the direct-current potential plug to the booster from which it is desired to supply the control potential.
3. Close the field switches of all booster exciters in service, closing first the one to which the direct-current plug is now connected.

CHANGING REGULATORS

1. See that the differential relay switch of the incoming regulator is closed.
2. Examine the incoming regulator and see that the switches connecting it to the booster-exciter field which is to supply the direct-current potential are closed. (See Rule No. 6, "Starting a Booster to Operate Alone.")
3. Open the field switches of all booster exciters in service, opening last the switch of the booster-exciter field to which the direct-current potential plug has been connected.
4. Change the selector control switch of the regulator in service to the incoming regulator.
5. Close the field switches of all booster exciters in service, closing first the one to which the direct-current potential plug is connected.

TAKING A BOOSTER OUT OF SERVICE

1. Adjust the generator field rheostats so that the booster voltage is reduced approximately to zero.
2. Open the field switch of the booster exciter.
3. Close the booster short-circuit circuit breaker.
4. Open the booster circuit breakers.
5. Shut down the booster-exciter motor-generator.
6. Shut down the booster motor-generator.

Redesigning Furnaces for Iowa Coal

OWING to an increased demand for power during the war central stations using high volatile Iowa coal were forced to consider improved methods of increasing their boiler ratings. Since Iowa coal has a volatile content of 36 per cent as against 16 per cent for Virginia coal, it is evident that a furnace designed for Virginia coal cannot successfully burn coal from Iowa. Fortunately a bulletin* had been published which showed that the furnace volume depended upon the excess air, the rate of combustion and the kind of fuel used. It also showed that since the rate of combustion or the number of pounds of fuel per square foot of grate surface per hour increases, the volume of the furnace must be increased proportionately.

The first stoker installation investigated followed generally the stokers designed for Illinois coal, but the ignition rates were low with consequent lower efficiencies. The first arch in the Cedar Rapids plant of the Iowa Railway & Light Company cleared the bridge approximately 24 in. in the center of the furnace and

*Bulletin No. 135 of the Bureau of Mines, entitled "Combustion of Coal and Design of Furnaces," by Henry Kreisinger, C. E. Augustine and F. K. Ovitz.

about 10 in. on the sides. Since the boilers were set approximately 8 ft. from the floor to the lower row of tubes, a limited combustion volume resulted. The only virtue of the peculiar installation of flat arches parallel to the grate was that it was cheaper to construct than the older sprung arch and that the maintenance was also lowered.

As a result of these combustion-area investigations the arches at the rear end of the stoker were raised slightly. This immediately resulted in increased boiler ratings and improved evaporation rates. Then, as these arches wore out in service, the angle between the arch and the grate was increased step by step until finally the rear row of arch tiles was tangent to the bottom of the boiler header. Since it was not possible from an economic standpoint to tear down the boilers and raise them up, other means had to be devised to increase the furnace volume. A modified form of bridge wall was designed to deflect the heat from its surface forward to the feed grate of the stoker.

The next step was to build an "L"-shaped arch, the long portion of the "L" being parallel to the grate and as high up from the grate as the physical dimensions of the boiler would permit. The vertical portion of the "L" was extended downward until it cleared the grate by approximately 18 in. It was made only long enough horizontally to meet the feed grate in order to secure sufficient surface of highly heated firebrick to assist in the ignition of the coal.

Before this arch development occurred evaporation rates of 5 lb. of water per pound of coal and boiler ratings not exceeding 110 to 125 per cent of nominal capacity were prevalent. Today the evaporation has increased to 6 lb. or 7 lb. of water per pound of Iowa coal while the boiler ratings have risen to 200 per cent and 250 per cent of rating.

Along with these changes the gas velocities have been lowered, thereby reducing the amount of ash carried in suspension from the fuel bed and with a corresponding reduction of trouble from slag formation on the tubes. The larger furnace volume with lower gas velocities gives less blowpipe effect on the boiler tubes, with a resulting reduction in the boiler tube maintenance.

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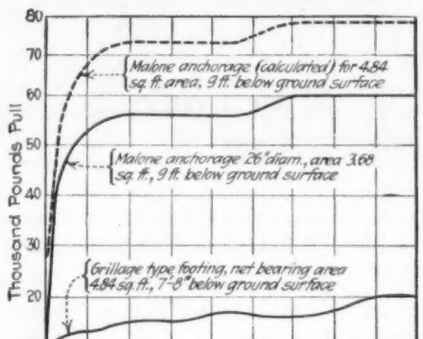
Anchorage for Overhead Line Structures

A METHOD has been developed in connection with a new type of footing for the anchorage of transmission towers and other overhead supports which not only materially increases the security and life of such anchorages over those made of wood or steel buried immediately in the ground without concrete protection,


Thousand Pounds Pull
Inches Uplift
Malone anchorage (calculated) for 4.84 sq. ft. area, 9 ft. below ground surface
Malone anchorage 26" diam., area 3.68 sq. ft., 9 ft. below ground surface
Grillage type footing, net bearing area 4.84 sq. ft., 7'-8" below ground surface

RESISTANCE TO UPLIFT OF MALONE FOOTING COMPARED WITH ORDINARY GRILLAGE

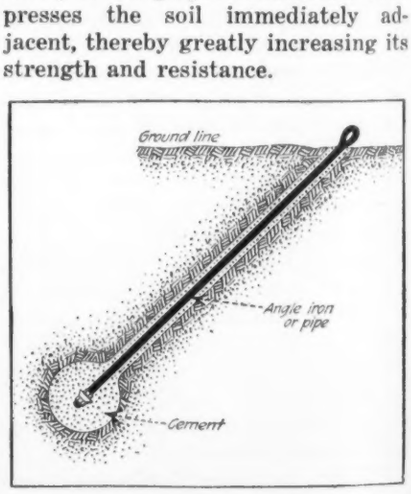
but also largely reduces the construction expense. This new anchorage, although a rather radical departure from past practice, has been sufficiently tested, both as to method and type, to assure its success, at least under the earth conditions that are usually encountered.

In May of last year the writer was assigned to take charge of the construction of a heavy steel-tower transmission line, 110 miles long, to connect two sections of the transmission network of the Kansas Gas & Electric Company in central and southeastern Kansas. Soil explorations were immediately started to determine the conditions to be met in designing tower anchorages. This survey developed the fact that over about 80 per cent of the entire ground to be traversed by the line there would be encountered formations of flint bearing limestone of sufficient hardness to make excavations for earth grillages difficult and expensive, but, on the other hand, of such an erratic and faulty nature as not to be reliable for the grouting of anchor bolts into drilled holes. With the aim of making an asset of this liability, efforts were directed to the development of an efficient tower anchorage which would successfully meet all of these rather unusual conditions and at the same time be adapted to any other conditions likely to be encountered, such as dirt, rock, boulders or combinations of these materials, and capable of being cheaply and quickly installed even in frozen ground.

A series of experiments developed the method and type of anchorage called the Malone anchorage. The installation of this anchorage is simple, the first operation consisting of boring a relatively small hole, or drilling this hole if in rock, and discharging within the hole at the desired depth below the ground surface a selected quantity of explosive. This expands a cavity in the dirt or rock of a size dependent upon the quantity of explosive and density of the material. An experimental hole, permitting inspection, is shown in one of the accompanying illustrations.

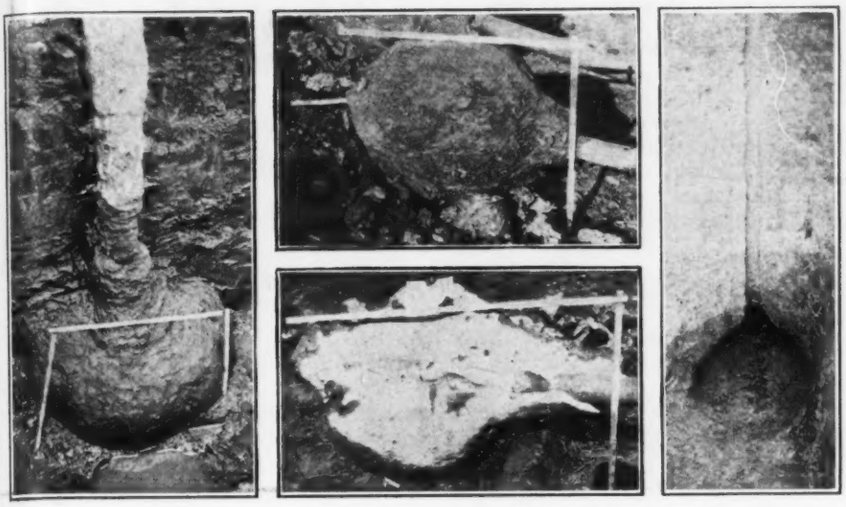
A specially designed column or tension member (frequently formed from angle iron or pipe) is inserted in the hole in correct position, with concrete poured or forced around it in the hole up to the ground surface or to any other desired height. When the concrete is sufficiently set up, the anchorage is ready for the attachment of the structures.

Some of the novel characteristics of the Malone anchorage result from the fact that the force from the explosion subjects the walls of the cavity to a high pressure which compresses the soil immediately adjacent, thereby greatly increasing its strength and resistance.



CONCRETE ANCHORAGE USES VARIOUS STEEL FORMS FOR CENTER

Beginning in June, a series of uplift and compression tests were conducted upon about fifty experimental anchorages. These experiments were sufficiently diversified to establish for the entire range of ground conditions encountered along the transmission line the sizes and types of anchorages required to carry the



VIEWS OF MALONE CONCRETE ANCHORAGE AS IT APPEARS IN PLACE, BROKEN OPEN AND HOLE WITH BULB WITHDRAWN

requisite loads both in tension and in compression. Analysis of the results of these tests brought out many features pertinent to this method of anchorage of which advantage is taken in its application. Among these, as applied to steel transmission towers, the following are of particular interest:

1. Extensive economies resulting from lower cost of material, lower cost of hauling and assembly, reduction in labor requirements, reduction of time element with attendant savings, and lessening of damage to crops and of injury to or loss of live stock sometimes caused by animals falling into open holes excavated for grillage footings.
2. The safe bearing value with this anchorage in compressed soil is well in excess of the accepted practice with undisturbed soil.
3. The rigidity of the column member is materially in excess of that which would be expected from the application of formulas developed for unsupported columns.
4. The earth being highly compressed during the process allows the application of a large percentage of its ultimate load before any movement of the anchorage occurs.
5. Essentially the same values are obtained for uplift and for compression, showing that the effective resistance to uplift is determined by the penetration of the "bulb" through the compressed earth rather than by lifting the conventional "cone of earth."

The accompanying curves show the results of comparative uplift tests upon a Malone anchorage with "bulb" 26 in. in diameter and a steel grillage tower footing of the usual type having an area more than 30 per cent greater. There is also shown a calculated curve corrected to the basis of equal areas. This test was made in clay ground that is normally firm, but saturated, and the grillage footing curve brings out the reduced holding power and tendency to flow of this class of ground when disturbed and tamped.

To give a comparative idea of the material and labor required for the Malone anchorage versus the usual grillage tower footing set in dirt, figures are given in table above.

While a comparison on the basis of actual cost is not available, it is estimated that on standard towers the saving will run from one-third to one-half the cost of the grillage footing as installed by the open excavation method.

	Malone Anchorage	Grillage Footing
Quantity of earth excavated, cu.yd.	0.04*	4
Quantity of steel, lb.	60	220
Quantity of concrete, cu.yd.	0.25	0

*Hole 5 in. in diameter and 8 ft. deep.

Applications of this anchorage are already being made in permanent construction as footings for steel transmission towers and guy anchors for wooden poles and other flexible supports used in transmission work.

A. W. MALONE,
Construction Manager,
Phoenix Utility Company,
New York, N Y.

Cable Test Equipment Placed on Motor Trailer

HIGH-VOLTAGE dielectric tests on cables and insulators are made in the field by the Edison Electric Illuminating Company of Boston with the equipment shown in the accompanying illustration. The motor truck at the left carries an induction motor which can be operated at 2,300 volts or 4,000 volts, driving a 100-kva., single-phase generator with a voltage range of zero to 2,300, besides the necessary control-panel installation. It is connected by cable with the trailer truck, which carries an 800-kva. transformer and an 800-kva. reactor in parallel with the low-tension side of the former. The transformer secondary range is zero to 30,000 volts. By this equipment the capacity load of the cable under test can be balanced, with corresponding reduction in generating requirements. Four to six men including chauffeur are required on tests.

FIELD EDITOR ELECTRICAL WORLD.
Boston, Mass.

APPARATUS USED BY BOSTON EDISON COMPANY IN MAKING FIELD TESTS

Inspections for Better Service

At Small Cost, Service Has Been Improved by Adjustment of Minor Causes for Complaints, Repairs to Appliances and Suggestions for More Economical Operation

WITH a large system extending over a wide area, such as that of the Consumers' Power Company in Michigan, service to the residential customer frequently does not receive the same attention as that of the commercial or industrial customer because the operation of household equipment is not of a complicated nature. Quite often, though, because of some local condition, the service may not be entirely satisfactory to the customer, or some of his appliances may be out of repair, and yet he will neglect to call upon the company to remedy the trouble. Such conditions mean decreased revenue for the company and sometimes result in misunderstandings and loss of the customer's good will.

With this in mind the Consumers' Power Company has inaugurated a plan of house-to-house inspection to uncover dissatisfaction on the part of the customer, make repairs and adjustments to household appliances and suggest ways of improving the use of the service. The method of conducting the inspection is interesting, and its results are particularly significant as they typify conditions which may exist among the customers of any central-station company. The Consumers' company operates both electric and gas utilities, and the reports of the inspection of gas installations are also included because of their value to combination companies.

Preliminary to making the house-to-house canvass of customers the inspectors were first thoroughly schooled in the various departments, such as meter trouble, appliance repairs and billing, in order that they might be familiar with various conditions which arise and be capable of making repairs or adjustments or answering questions or complaints. As the term implies, an inspection was made of every house adjacent to the gas or electric distribution system. The primary function of the inspection was to render a service to the customer and not to sell appliances or equipment, and the inspectors were instructed that they should not attempt to sell anything even if it was specifically asked for by the customer. In the latter case a salesman is notified of the "prospect."

The inspector presents to the customer a card of introduction with his personal signature. This card explains fully his mission and introduces him as a representative of the company. While this may seem to be a formality, it was greatly appreciated by the customers in that it was a means of identification and they had the name of the inspector if they desired to ask for additional information.

In order to simplify the work of the inspector, cards were prepared which listed the chief appliances to be inspected, repaired or adjusted if necessary, and a record was made of the conditions found. The electrical inspection card is shown here.

Upon entering the house, after presenting his card of introduction, the inspector records accurately the name and address of the customer, noting the general type and use of the building. The service is inspected, low-hanging wires, loose brackets and number of customers supplied being noted, and anything needing repair is reported immediately to the service department. The standard safety cabinet, if any, and the meter are then inspected, with particular attention to the safeness of the installation, open wiring or anything that might prove to be a hazard. The meter number and index readings are recorded.

Fuses are removed and inspected to make sure that the customer is properly protected. Many cases have been found in which coins, nails and heavy wire have been used for fuses. Customers' comments are also reported, whether favorable or unfavorable. These comments, if they are unfavorable, and any direct complaints are either investigated and the trouble corrected at the time by the inspector or are referred to one of the departments, which issues an order for the necessary work to be done. An inspection is also made of all appliances, and minor repairs, such as to broken cords, sockets and loose conections, are made where nec-

Form EG10-445

Name and Address

INSPECTION CARD
General

Date Inspected..... Inspected by.....
.....Fam ly Appt. Double House..... Rooming House.....
Boarding House.....

ELECTRIC INSPECTION

Service Connection Installed? Yes.... No.... Condition of Service Connection .....
Number of Customers on this Service Connection?..... Is house wired? Yes.... No....
Are Fixture installed? Yes.... No.... Is Standard Safety Box installed? Yes.... No.... Sealed. Yes.... No....
Is Meter installed? Yes.... No.... Company Meter No.....
Meter Index..... Main Line Fuses: Size..... Amp. Condition .....
Is Electric Service Satisfactory? Yes.... No.... If not, give reason .....
State customers' comments .....

APPLIANCES

Description	Yes	No	Kind, Size, Condition and Adjustments Made
Flat Iron			
Vacuum Cleaner			
Washing Machine			
Toaster			
Sewing Machine			
Heater			
Percolator			
Lamps and Fixtures			

FORM OF CARD USED FOR ELECTRIC INSPECTION

essary. In the event that the appliance must be taken to the shop the nature of the trouble is explained and the approximate cost given. Then with the customer's consent the repairs are made.

Each day the inspection cards are turned over to the district manager, and he or some one delegated by him checks them over carefully, noting condition of meters and services and seeing that all major repairs necessary are made. The chief clerk next checks the cards with the ledgers, noting whether the name, address, meter number, meter reading and other ledger records are correct. The cards are then filed in permanent card files for future reference, particularly by the commercial department in laying out sales plans and building up "prospect" lists for new business.

It has been found that the inspection is rendering a great service to many of the customers, in that low-voltage conditions have been improved, service wires repaired, dangerous meter conditions corrected, gas and electric appliances repaired and adjusted, fuses of proper capacity installed and complaints of various conditions answered.

Out of the 35,230 inspections made, there were 13,590 individual repairs or adjustments made or complaints answered. Many of these were of minor importance. However, it is evident that the results being obtained fully warrant the expenditure and that from 20 to 25 per cent of the customers are receiving a service which is a direct benefit to them in the use of gas and electricity.

The accompanying summary shows in detail the result of the inspection as of Dec. 1, 1922.

Inspector's Introduction Card

TO OUR CUSTOMERS:

The bearer will present to you credentials showing his name, company badge and his photograph, identifying him as a representative of this company.

With your permission, he will examine your gas and electric appliances and make, without charge, the minor repairs and adjustments that may be necessary to make their use more satisfactory to you.

His call is solely in the interest of better service. He is not a salesman and has nothing to sell.

If you will give him the opportunity, we feel sure the adjustments he will make and the advice he will give you will be helpful to you.

CONSUMERS' POWER COMPANY.

Presented by .....

SUMMARY OF HOUSE-TO-HOUSE INSPECTION

Total number of inspections made 35,230

	Combination Properties	Straight Electric Properties
Number of inspections made	18,835	16,395
Number of inspectors working	15	7
Average inspections per man per day	14	23
Average cost per inspection, cents	38	20.5
	Gas	Electric
Number of lost meters found	2	..
Defective or improper size meters	45	35
Number of inaccurate meter numbers corrected in ledgers	74	87
Inaccurate meter readings reported	18	34
Poor meter connections	155	118
Cases of theft	4	26
Services not in use	510	714
Lost services found	46	..
Service wires to be repaired	..	639
Gas service—cleared	139	..
Repaired	17	..
Too small	8	..
Regulator trouble	204	..
Service brackets loose	..	396
Houses piped or wired but no service supplied	14	134
Lights flickering	..	225
Poor service—poor pressure	281	..
Low voltage	..	443
Safety cabinets installed	..	10,410
Safety cabinets seals broken	..	1,109
Appliance trouble	2,997	1,223
Lights	130	..
Customers dissatisfied with service	127	565
Customers stating they are satisfied	5,774	19,567
No fuse protection	..	735
Fuses renewed	..	2,523
Complaints—against employees	6	21
On shut-off notices	5	6
On reading meters	16	39
On bills	565	1,287
On delivering bills	23	25
On installation of safety cabinets	..	1
Number of houses not using service	2,380	4,154

Cost of Electric Pumping in Oil Fields

COMPARATIVE data prepared by the San Joaquin Light & Power Corporation on the use of electricity in the oil fields of Kern County, California, show that the cost of electric pumping is much less than by any other method. With 3,000 wells being pumped electrically from the lines of this one power company, the figures cover a wide range of possible variation in conditions and represent a true comparison of electric, gas and steam engine drive.

The lump operating costs without details for individual oil-well installations for one division of a large oil-producing company are per day per well as follows: Electric drive, $1; gas-engine drive, $2.16; steam-engine drive, $5. These figures are based on the installation of individual electric motors or gas engines at each well, or the installation of one steam boiler serving fifteen individual steam engines, each driving one well.

The motors used in oil-well operation are two-speed, rated at 15 hp. or 30 hp., the lower rating being used for pumping and the higher rating for pulling, casing and drilling. The average load when pumping in one particular district is about 6 hp. At present prices of oil, the operating cost of steam installations is the same whether oil or natural gas is burned under the boiler.

Cleveland, 1922, Appliance Sales Were $15 per Customer

CONCRETE evidence of the value of co-operation between the central station and the contractor-dealer in building up a large volume of appliance business is revealed in a survey recently made in Cleveland. While the Cleveland Electric Illuminating Company does not engage directly in merchandising, it gives its whole-hearted support to all of the activities of the city's electrical interests. As has been noted from time to time in the ELECTRICAL WORLD, the company has participated in electrical home exhibits and has joined with the dealers and electric shops in formulating and carrying out sales programs. How well this has worked out is shown in the accompanying tabulation of information concerning eighty-five electric shops in Cleveland.

Analyzing these figures briefly, G. E. Miller, sales manager of the Cleveland Electric Illuminating Company, says:

"The data given cover only so-called electrical shops—that is, contractor-dealer stores—and do not include or make any allowance for sales made by our large stores, hardware stores, drug stores or automobile supply houses, all of which sell more or less electrical merchandise; in fact, the large stores are selling large quantities. I have just had a report of one of the stores which, in a special sale, sold 243 washing machines in one day and on another day sold fifty-nine mangles. Another large store had special sales on washing machines running as high as from fifty to sixty washing machines per day.

"I have made the statement, which I believe is very conservative, to the effect that the sale of domestic appliances in Cleveland in 1922 was in excess of $3,000,000, not including in that figure lamps, electric fixtures, wiring material, sockets and so forth. That is approximately $15 per residence consumer in the territory and approximately $3.40 per capita.

DATA ON APPLIANCE SALES IN CLEVELAND ELECTRIC SHOPS*

Number of appliance dealers	85
Total space devoted to display of electrical merchandise, sq.ft.	53,095
Number of display windows	145
Frontage of all dealers' windows, ft.	1,592
Number of salesmen—in stores	145
Number of outside appliance salesmen	254
Total number of appliance salesmen	399
Average number of appliances sold each month	7,039
Total for one year	84,468
Value of appliances sold in 1922	$2,765,406.00

*Not including department-store sales or sales made by other than electrical stores.

"You will note that the total number of appliance salesmen is given as 399, in addition to which it is safe to assume that there are probably fifty more, or say a total of 450 men, whose entire time is devoted to the retail sale of electrical equipment in Cleveland and its suburbs. To get another picture of what this sales effort means—if we were to assume that these men were working at the ridiculously low figure of $125 per month, this represents a payroll of $675,000 per year. Obviously, they would have to sell much more than $3,000,000 worth of merchandise to warrant any such outlay for sales effort."

Operating Costs of Municipal and Private Plants

ANALYSIS of the operating costs of privately owned and municipal utilities in Indiana, compiled from annual reports filed with the state Public Service Commission, show that the operating costs of the municipal utilities is far greater than that of the other class, according to a statement made at the commission offices.

In the statistics compiled private and municipal electric utilities are compared. The disposition of each $100 of revenue is shown. The municipal utilities pay much more for coal than the private concerns. More also is paid for wages and salaries by the municipal utilities, which are to some degree mixed up with politics.

Out of each $100 of revenue received by electric utilities the privately owned company spends $63.93 for operating expenses, whereas the municipally owned utility spends $73.44. The figures are based on the reports for 1921.

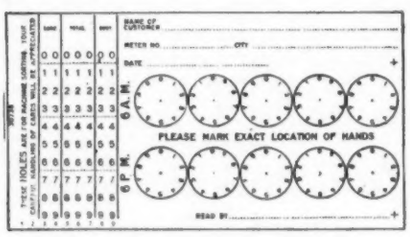
The accompanying table shows the difference in costs for various items. It will be noted that very little has been set aside by the municipal plants for depreciation.

	Private	Municipally Owned
Salaries	$3.41	$3.68
Wages	14.35	18.58
Material used on repairs	3.82	6.09
Fuel, current, steam	25.94	36.24
Other operating expense, including depreciation	15.41	8.85
Total above	$63.93	$73.44
Taxes	7.68	*000
Total operating expense	$71.61	
Balance applicable to interest, dividends, surplus, etc.	28.39	26.56
Total	$100.00	$100.00

*Municipally owned utilities do not pay taxes, these being an added tax burden to the citizens of the city served.

A Check on Registration of Power Meters

ON AN extensive system like the Southern Power Company's, which serves industrial loads, it is very important that some check be kept on the registration of meters between the regular monthly calls of the meter readers, otherwise the failure of a meter to record may entail serious loss to the company. Furthermore, since the company sells both primary and secondary power (primary power being power for twelve months of the year and secondary power that which may be provided for less than twelve months upon proper notice), it is desirable to ascertain whether a consumer is complying with his contract. Consequently the Southern Power Company has required (by contract) all its industrial consumers to mail their meter readings regularly on a post card like that reproduced herewith. When these are received they are punched on a Hollerith machine according to zone, substation and consumer number for automatic sorting. After being sorted the readings are transferred to permanent records for the purposes formerly mentioned.



POST CARD USED FOR RECORDING METER INDEX

While these cards may not be used in exactly the same way by all companies, it is possible that they can be used by companies serving sparsely settled teritories to reduce the cost of meter reading. With these readings received monthly it might be necessary only to send a meter reader around every three months to consumers whose bills are comparatively small. It is possible too that the punching system might be arranged to permit using the cards for directly billing the customers; that is, for stamping the amount due on the customer's bill.

What Other Companies Are Doing

Oklahoma City, Okla.—To facilitate the supervision of its properties west of Oklahoma City, a western division of the Oklahoma Gas & Electric Company was established on Jan. 1, to take in all the properties in the Enid and El Reno divisions. The Oklahoma City division will comprise the properties in Oklahoma City, Moore, Norman, Britton, Bethany and Yukon.

Boston, Mass.—Utilities operated by Charles H. Tenney & Company sold electrical appliances in 1922 to the amount of about $420,000, the total gas and electric appliance sales being approximately $700,000. As a slogan for 1923 on total appliance sales, these companies have adopted the phrase "A Million or More—Before '24." Cyrus Barnes is general sales manager.

Louisville, Ky. — The Kentucky Utilities Company's lighting-fixture sales during the year 1922 amounted to $30,191.77. The fixtures were sold under a consignment arrangement for twenty-two of the company's offices. This business was done with a stock of $6,000 in fixture samples. Selling assistance was also furnished by the fixture jobber.

Chicago, Ill.—Plans for a series of active campaigns dealing with electric appliances in familiar use are being perfected by the retail merchandise sales department of the Public Service Company of Northern Illinois. It is intended to continue the policy of arranging in advance every detail of the advertising and publicity which will characterize the sales, extending this to the point of arranging in each salesroom a prominent display of the article or articles involved. The idea which was followed out last year aided materially in obtaining results in 1922, which showed an increase of 66 per cent over the sales of the year previous. The advantage of pushing appliances most in use at the particular season has been demonstrated and the lesson learned will be heeded.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press from All Parts of the World

Hydro-Electric Development and Steam Equipment

Siphon to Maintain Constant Water Level.—F. HEYN.—The author describes a siphon which automatically takes care of the maintenance of a steady and predetermined water level in a dammed river. Because of the peculiar shape of the cross-section of this siphon it fills itself with water and starts to operate without any attendance. It would appear that such an apparatus could be used only on very small water plants, but the author states that one of these siphons will be installed at a new Bavarian hydro-electric station capable of passing 110 cu.m. of water per second.—*Elektrische Kraftbetriebe und Bahnen*, Dec. 24, 1922.

Development of Stokers.—The January issue of the *A. S. M. E. Journal* contains three papers dealing with the various types of stokers that have been developed for the firing of boiler furnaces and that were presented at the annual meeting of the society. They are "The Development and Use of the Modern Chain Grate," by T. A. Marsh; "Overfeed Stokers of the Inclined Type," by G. I. Bouton, and "The Design and Operation of Underfeed Stokers," by H. F. Lawrence. A fourth paper, "Tests of a Large Type W Stirling Boiler," by P. W. Thompson, is also included. Abstracts of these four papers may be found in the convention report published in the ELECTRICAL WORLD for Dec. 9, on page 1288. —*Mechanical Engineering*, January, 1923.

Electric Drive for Turbine Auxiliaries.—J. M. DRABELLE.—The author gives the rating of the electrically driven turbine auxiliaries in the Iowa Railway & Light Company's power station, describing their automatic features and giving operating data from the results obtained. He strongly advocates driving power-house auxiliaries with electric motors in preference to any other method.—*General Electric Review*, January, 1922.

Generation, Control and Switching

Paralleling Troubles.—J. GEIGER.—The author reports two rather unusual experiences with the parallel operation of alternators. In one case where a steam turbine-generator was operating in parallel with a belt-driven generator the pointers of the ammeter and wattmeter of the latter were swinging periodically between normal values and twice normal values, and this was found to be caused by a resonance phenomenon of the instrument systems with the periodic knock of the belt lock upon the generator pulley. In the second case a Diesel motor power plant, with units of 100 kw. to 1,000 kw., operated in parallel with a 1,000-kw. steam turbo-generator. The instruments of the Diesel plant indicated periodically very heavy overloads, while the meters of the steam plant were quiet. The cause was found in the totally different character of the speed regulators used in the two plants. The regulator of the turbine was rather sluggish, while the oil motors had very sensitive regulators. In case a slight increase of load came on, the combustion motors responded much more quickly than the steam turbine and carried therefore temporarily a much higher load. An addition of oil dash pots to the regulators of the Diesel motors brought complete remedy for this trouble.—*Elektrotechnische Zeitschrift*, Jan. 4, 1923.

Transmission, Substations and Distribution

New Disk-Type Insulator.—A. VAUPEL.—A cap-type chain insulator is described, very similar in outer shape to the recently developed "sphere-head" insulator. But the fastening of the rod within the head of the insulator is accomplished by means of a number of peculiarly arranged small iron pieces, assembled obliquely and concentrically around the rod. No cement is used. Comparative data for four types of insulator are given in the table. —*Elektrotechnische Zeitschrift*, Jan. 18, 1923.

	Hewlett	Cemented-Cap Type	Sphere-Head Type	New Type
Puncture under oil, in kv..	100	130	160	180
Mechanical strength, in kg. per sq.cm.....	3,500	3,500	5,000	5,830

Cement Bases for Wooden Poles.—T. PANSERT.—This paper describes a method developed by M. Ponsolle of providing cement bases for wooden poles. The base consists of a cylindrical cement tube, conical on the inside and about 3 m. in height. The pole rests with its tapered end within the conical part of the tube, and its outside diameter is somewhat smaller than the inside diameter of the base tube, so that there is free access of air and ready drainage of water, both tending to prevent premature decaying of the pole butt. Wedge-shaped spacers hold the pole concentrically. A similar but two-part cement tube is described, to be used on poles already set. The method has been tested since 1908 and has been found to be both cheap and effective.—*Revue Générale de l'Electricité*, Jan. 20, 1923.

Static Condensers for Power-Factor Correction.—R. E. MARBURY.—Correction of power factor with static condensers, fundamentals of condenser design, factors of safety adopted and the application of static condensers to power lines are the main subjects discussed.—*Electric Journal*, February, 1923.

Units, Measurements and Instruments

Simplified High-Potential Test of Insulating Materials.—G. J. MEYER.—To permit quick routine testing of pieces of insulating material a small handle with two point contacts spaced 5 mm. apart is described. The points are connected to a source of 3,500 volts to 4,000 volts, and are placed upon different parts of the piece under test. Perfect material will stand the test without any sparking or burning, while defective or moist pieces will cause a surface arc between the points. It is explained how the character of the burn gives a clue as to the nature of the defect in the material. The method has been used successfully for several years by the Dr. Paul Meyer Company in testing insulating materials intended for use on 500-volt work.—*Elektrotechnische Zeitschrift*, Jan. 4, 1923.

Motors and Control

Small-Capacity Synchronous Motor.—L. SCHÜLER.—A series of small self-excited synchronous motors, in capacities from 3 kw. to 22 kw., is described. The motors have a wound armature, to which is connected a commutator for the direct current excitation and three collector rings. The armature receives the line current through the slip rings, while the stator is connected to the starter. The commutation is claimed to be sparkless even at high overload start or run. The motor starts under full load as an asynchronous motor, synchronizes quickly, and runs then as a synchronous motor with all the advantages of that type. At a load exceeding the normal rating the rotor falls out of step and runs as an induction motor until the load decreases, when it assumes synchronous speed again. This change is not noticed save for a drop of the power factor from unity to about 80 per cent. The advantages claimed are that the efficiency is slightly above that of an equivalent induction motor, the current consumption is about 15 per cent less, the iron losses are lower and the cost is about 20 per cent to 25 per cent higher. The latter item is partly compensated by the higher output which the motor gives when running as a synchronous unit.—*Elektrotechnische Zeitschrift*, Jan. 4, 1923.

Maintaining Electric Railway Motors.—J. S. DEAN.—Particular care should be used when replacing field coils in motors to insure that they are connected properly and that the correct

polarity is obtained. Various methods for testing are given.—*Electric Railway Journal*, Jan. 20, 1923.

Illumination

Use of Artificial Illuminants in Kinema Studios.—L. A. JONES.—The subject is treated under the following two divisions: (a) the study of the characteristics of photographic materials and their response to different forms of radiation, and (b) the effect of light and radiation on the human eye. The first part is given over to a definition of photographic terms and units and an estimation of the effect of various illuminants in photographic work. The second part is devoted to the possibilities of injury to the eye of workers in kinema studios through radiation of harmful qualities or excessive intensity.—*Illuminating Engineer*, Vol. 15, Nos. 9 and 10.

Specifications Governing the Acceptability of Electric Tail Lamps for Motor Vehicles. — Specifications have been drawn up by the committee on motor-vehicle lighting of the I. E. S. and the lighting division of the standards committee of the Society of Automotive Engineers. They have been drawn to apply only to illumination by electric lamps of opaque registration number plates for use on automobiles, trucks, and motor cycles.—*Transactions of the I. E. S.*, February, 1923.

Heat Applications and Material Handling

Electric Heating of Rivets and Forgings.—J. SAUER.—This paper describes the latest types of stationary and portable rivet heaters, with interesting curves on the efficiency, the power factor and the energy consumption of the apparatus. To estimate the energy required to heat a certain piece of steel, the author gives the formula $Q = 0.11 \times G \times t$, wherein Q denotes heat energy in kilogram-calories (1 kw.-hr. = 864 kg.-cal.), G is the weight of the piece in kilograms, t is the desired temperature, and 0.11 is the specific heat of steel at 1,000 deg. C.—*A. E. G. Mitteilungen*, December, 1922.

Arc Welding.—O. H. ESCHHOLZ.—The author reviews the recent progress of arc-welding activities. Fusion welds, mechanical working, arc phenomena, penetration and high-speed welding are considered. Tables included give the rate of metal deposition, maximum welding speed for ½-in. plate using butt joints, and maximum welding speed for ½-in. plate using lap joints.—*Journal of American Welding Society*, January, 1923.

Electrophysics, Electrochemistry and Batteries

Durable Insulating Oils.—C. J. RODMAN.—In searching the entire field of inorganic and organic liquids only a few liquid dielectrics were found to be adapted to insulation purposes, such as the use of oil in transformers, switches, lightning arresters, etc. Those compounds most nearly meeting the requirements are a small number of mineral oils, known as paraffine and naphthene hydrocarbons. The best commercial oils are derived from petroleum crudes and have very good physico-chemical characteristics.—*Electric Journal*, February, 1923.

Apparatus for Determination of Magnetic Properties of Short Bars.—M. F. FISCHER.—A description is given of the apparatus and methods developed for the magnetic testing of single specimens 10 cm. long and 0.6 cm. in diameter. As the magnetic properties of small samples are difficult to measure directly, a method has been adopted which involves the comparison of the test bar whose properties have been previously determined by calibration with several standard bars. The accuracy attainable with this method is entirely satisfactory, the errors in most cases being less than 5 per cent.—*Scientific Paper, No. 458 of the Bureau of Standards.*

Traction

Reducing Lubrication Costs.—H. M. ROBINSON.—Methods of lubrication and amount of lubricant used on various types of motor and journal bearings on the rolling stock of the Northern Texas Traction Company and Tarrant County Traction Company, Fort Worth, Tex., are recounted. Cost of rolling-stock lubrication per thousand car-miles, amount of oil needed for car and regular inspection, oiling schedule for cars, etc., are given in tabular and curve form.—*Electric Railway Journal*, Jan. 20, 1923.

Electric Railways Crossing Swinging Bridges. — G. VALLECCHI. — When an electric railway crosses a swinging bridge the continuity of the line must be assured at all times. This article explains how the author solved this problem recently in Taranto, Italy, by feeding the contact wire and rails exactly to the two shafts where the two parts of the bridge swing. These two points are permanently connected together and in contact with the two branches of the railroad on either side of the river by means of cables. Swinging contacts, flexible or shiftable, are absolutely avoided, and no special assistance is required.—*Elettrotecnica*, Nov. 15, 1922.

Telegraphy, Telephony, Radio and Signals

Alternating-Current Telegraphy with *Acoustical Frequency.*—F. LÜSCHEN.—The unreliable operation of single-wire telegraph lines and the inductive interference caused by high-voltage lines, and specially railway feeders, made it necessary to rebuild the telegraph lines for double-wire cable, as has been done with telephone lines. The considerably increased cost of such double lines was counteracted by their multiple use. A new system of multiple telegraphy with alternating currents of different frequency is described. This system permits "Pupinized" lines, such as are used for telephone service, to carry simultaneously six telegraphic messages with six different frequencies between 400 cycles and 1,700 cycles per second. Specially adapted electron tubes act as oscillators, amplifiers and rectifiers at voltages equal to those customary in telephony. The Siemens rapid machine telegraph, with perforated paper ribbon, gives a speed of six hundred to seven hundred letters per minute for each of the six messages. At the receiving end the usual band filters, each tuned for its particular frequency, separate the six codes again. The author enlarges upon the many difficulties which had to be overcome to make this system operate reliably. It is installed on the cable between Berlin and the Rhineland.—*Elektrotechnische Zeitschrift*, Jan. 4 and 11, 1923.

Miscellaneous

Developments in the Electrical Industry During 1922.—JOHN LISTON.—Although progress in the electrical industry was mainly along established lines, there was a well-defined tendency in practically every phase of construction of electrical apparatus to concentrate the generation, transformation and distribution of electrical energy in units of greater capacities and with higher guaranteed efficiencies than in previous years. This is illustrated in one instance by the increase in transformer sizes, as shown in the accompanying table. The maximum rating for steam-turbine generator sets was advanced to 62,500 kva. and that for waterwheel generators to 65,000 kva. The first electrically propelled ferryboat was placed in service last summer. Automatic station practice made further technical and commercial gains, with a steady increase in the unit capacities of the equipments and improvements in the design of the small-sized but very important devices which make automatic operation not only feasible, but fully as reliable as hand operation. Among other items of interest in widely varying fields were a new type of induction furnace for melting non-ferrous metals, the production of a highly efficient steam generator for use where surplus electrical energy is available, the "pallophotophone" for recording and reproducing sound, the 30-kw. incandescent lamp, radio and power tubes of unprecedented capacity, and further development of the million-volt testing set for commercial and research work. The review is forty-five pages long, amply illustrated. — *General Electric Review*, January, 1923.

AVERAGE UNIT SIZE OF POWER TRANSFORMERS IN KVA.

Year	Self-Cooled	Water-Cooled	All Types
1919	1,175	4,325	2,150
1920	1,325	3,175	2,175
1921	1,575	4,150	2,750
1922	1,700	6,000	3,750

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Lieb on Coal Situation

How the Threatened Harm to Utility Operation from Fuel Scarcity May Be Combated

SPEAKING before the regular monthly luncheon of the New York Electrical League on Wednesday of this week, John W. Lieb, vice-president New York Edison Company and chairman of the joint fuel committee representing the national electric light and power, electric railway and gas associations, which has been an active factor in obtaining fair treatment for the utilities during and since the coal strike, gave a comprehensive résumé of the whole fuel situation as it affects the utilities and especially the central-station companies dependent on steam operation. After sketching the importance of these utilities in the life of the nation, Mr. Lieb dwelt on the imperative necessity of their obtaining an adequate supply of good coal if their service to the public is to be maintained. Such a supply, he pointed out, has been placed in jeopardy by the changes recent years have brought in the coal-mining industry. From 1910 to 1920 there was an increase of 154 per cent in the number of mines, with only 37 per cent increase in output. As a result, in 1921 the average number of days in which individual miners worked was only 149. This whole condition not only increased overhead and hindered efficient collection and distribution of coal by the railroads but led directly to the strike. The strike was speedily complicated by the troubles with the railroad shopmen. The ultimate result to the utilities has been scarcity of fuel supply, enormous increase in cost and deterioration of quality, with attendant injury to furnaces, lessening of efficiency and forced reduction of storage. With 20 to 40 per cent of the total operating cost and 70 to 80 per cent of generating cost due to coal, the steam-electric utilities were harder hit by the situation than any other industry. Their coal contracts have proved of little value during emergencies unless they are protected by priority orders.

What Are the Remedies?

Mr. Lieb then turned to the remedies for the grave ills to which the fuel situation has given rise. He advocated more extensive storage by the railroads and at the mines themselves, which would permit the miners to work with greater steadiness. The more general use of electric machinery by mines would also be of much benefit; at present only half of them use electric coal-cutting machinery and the total mine power supplied by central stations is only 880,000 hp. The value of generating stations at the mouth of the mine when sufficient water can be had, the feasibility of pumping coal to market and the advantage that would follow the construction of superpower transmission lines were dwelt upon in turn, and the high economy of great central stations like the one at Hell Gate, which produces a kilowatt-hour on 1.35 lb. of coal, was alluded to.

Expressing his determined opposition to government ownership and operation of mines, Mr. Lieb declared himself in favor of continued private ownership with government regulation such as utilities are subject to.

Mr. Lieb spoke to a large gathering, including many prominent executive officers of public utilities.

Fight to Abolish the Utah Commission Fails

A determined fight made by stageline companies and other opponents of the Utah Public Utilities Commission to bring about its abolition was frustrated this week, when a bill to accomplish that end was killed in the Legislature. A number of other bills concerning the duties and powers of the commission are now before the Legislature.

Rumored Merger of McKinley and Studebaker Interests

Persistent and apparently well-founded rumors in the financial district of New York point to a change in the control of the Illinois Traction Company and its consolidation with the so-called Studebaker group of utilities into a two-hundred-million-dollar company. The Illinois Traction Company, of which Senator William B. McKinley is president and H. E. Chubbuck vice-president executive, is one of the largest holding companies in the United States, operating—besides 600 miles of electric railway—light and power companies and gas plants in cities of Illinois, Iowa and Kansas. The Studebaker properties are embraced in the system of the North American Light & Power Company, of which Clement Studebaker, Jr., of South Bend, Ind., is chairman of the board and William A. Baehr of Chicago president and general manager. The company, incorporated in Maine in 1915, owns and controls subsidiary operating companies in the light and power field serving a population of more than 300,000 in 104 communities in Missouri, Ohio, Illinois and Oklahoma.

Culminating New York Bill

New Administration Measure Meant to Insure City Control of Utilities Within Boundaries

AN ADMINISTRATION bill embodying sweeping "home rule" provisions for the regulation of public utilities and held to be even more significant than the measures described in the Electrical World last week (page 467) was introduced in the New York State Legislature on Tuesday of this week. This measure has been drawn in accordance with recommendations contained in the Governor's first message and confers almost mandatory jurisdiction upon all cities of the state to regulate their own public utilities—mandatory in the sense that every city will assume such jurisdiction unless by a resolution of its governing board approved by the Mayor it shall elect to have the public utilities within its border regulated by the Public Service Commission of the state. The newly created bodies are to be called "city public utilities commissions." Their term of office and compensation are left to the judgment of the governing board of each city, which may, if it see fit, require an existing city body or officer to act as such a commission.

Liberal "Home Rule" Provided

This is the measure giving to upstate cities power to deal with local transit, gas and lighting companies. It applies to all public service utilities in New York City except transit. The bill has twice been withdrawn for amendment, once at the suggestion of corporation counsels from the upstate cities. Now it is said to be in such shape as to be satisfactory to the larger upstate cities, especially Buffalo and Syracuse. Its notable feature is that it allows local regulation of all of that portion of a utility lying wholly within a city, with power reserved to the State Public Service Commission to establish and enforce rates or charges for through services rendered, whether alone or in conjunction with any other corporation, by any utility not wholly within a city; to prescribe a uniform system of accounts, to require the filing of schedules and tariffs, or to approve the issuance of stocks or bonds by all public utilities.

The political possibilities of the application of the proposed law are said to be many, and it is predicted by competent critics that, if the bill becomes law, there will be much conflict of jurisdiction between the state body and the local utility commissions, much that

the companies affected will place their own interpretation on and much that the courts will be called upon to determine. It is even said that, instead of the problem being solved, there is a possibility that in many cities the upshot will be no real regulation at all.

The public service committee of the State Senate will on March 14 hold a hearing on the bills previously introduced for the regulation of public utilities.

New Central-Station Use for Radio

Commonwealth Edison Company Broadcasts Its Annual Report—Fifteen Hundred Stockholders at Meeting—Dividends and Surplus for 1922 More than $6,250,000

WITH an attendance of approximately 1,500 stockholders, overflowing into the corridors, and a radio audience of unknown proportions comprising stockholders, customers and any others who cared to "listen in," the Commonwealth Edison Company destroyed all chances of charges of secrecy at the annual meeting of its stockholders held last Monday afternoon at 5 o'clock. The entire proceedings of the meeting were, in accordance with advertisements in Saturday and Sunday newspapers, broadcasted from the Westinghouse Electric & Manufacturing Company's radiophone station on the Edison Building. It is not yet known over how wide a territory outside the city the proceedings were heard. The matter sent out included the formal proceedings of the meeting and the address of President Samuel Insull. This is believed to be the first instance in which any attempt has been made to broadcast such matter.

President Insull said that there were 600,000 shares of stock entitled to vote at the meeting, of which 451,906, or slightly less than 80 per cent, were represented personally or by proxy. Of these 90 per cent are owned in Chicago and another 5 per cent in Illinois outside of Chicago. Ninety-six per cent of the stockholders own 90 per cent of the outstanding stock. Mr. Insull gave the number of stockholders as 28,489. Of 7,098 employees, 1,129 of whom were added last year, Mr. Insull said that one in three is a stockholder.

The revenue of $43,107,955 for the year 1922 shown in the company's annual report is an increase of nearly $6,000,000 over 1921. Mr. Insull gave the budget for plant expenditures for the coming year as $23,000,000. Approximately $3,500,000 is to be spent on the new Crawford Avenue station now under construction, $7,500,000 in finishing the Calumet station and $500,000 to $600,000 on other stations. It is estimated that the following approximate amounts will be spent on other items: Substations, $3,000,000; conduits, $2,000,000; underground cables, $1,250,000; overhead construction, $3,000,000; meters, $1,300,000 to $1,400,000, and miscellaneous items, $800,000. Mr. Insull estimated that the total expenditure for the coming five years would be in the neighborhood of $100,000,000. He prophesied that the company would have almost 1,000,000 kw. in plant capacity by 1925.

Attention!

Commonwealth Edison Company
Stockholders and Customers

Radio to Broadcast Stockholders Meeting, 5 P.M., Monday, February 26, 1923

The annual meeting of the stockholders of the Commonwealth Edison Company will be held at 5 p. m., Monday, February 26th, in Customer's Hall, Edison Building, 72 West Adams Street.

We have today approximately 27,000 stockholders as well as 615,000 customers. Because of the great growth in number of stockholders and the desire of the management that all be as closely informed as possible in regard to the company's affairs, the radio will be utilized to broadcast the proceedings of the annual meeting of stockholders.

This will be good news particularly to those stockholders who will be about their housework at five o'clock or who may be out of the city and unable to attend.

The entire proceedings will be broadcasted from Station KYW of the Westinghouse Electric & Manufacturing Company located on the roof of the Edison Building.

Promptly at 5 P. M., Central Standard Time, the meeting will open. The annual address of Mr. Samuel Insull, President, will directly follow the formal reading of minutes of the previous meeting, the counting of stockholders' votes and disposal of formal motions.

Customers of the Company are also invited to "listen in" as Mr. Insull will undoubtedly have something interesting to say about the future.

This is the first time in the history of any corporation that a meeting of the stockholders has been thrown open to the general public via radio. The Commonwealth Edison Company will be pleased to hear from stockholders, particularly those living at distant points, as to the success of this undertaking.

Commonwealth Edison Company

ADVERTISEMENT IN CHICAGO NEWSPAPERS

THE ANNUAL REPORT

The electrical operating revenue of the company, the annual report showed, totaled $43,107,955.71, with electric operating expenses (including amortization and depreciation of $3,287,311.67) amounting to $28,418,946.77. The net income available for dividends after all interest items were paid was $6,276,374.77, of which $4,602,416 was paid out for such purposes and $1,673,958.77 carried to surplus. An increase of $1,600,000 in the cost of operation due to the coal strike during the year occurred, but was more than offset by the profit derived from the very large increase in operating revenue. In all 73,321 consumers were added to the company's lines in 1922, making a total at the end of the year of 610,303. The total energy generated in 1922 was 2,225,443,000 kw.-hr., as against 1,928,272,000 kw.-hr. in 1921. The maximum load was 600,000 kw., as against 526,000 kw. in 1921, or an increase of about 14 per cent. The free delivery of lamps, which had been curtailed during the war, was resumed last February.

The issuance of $12,000,000 additional capital stock and the action of the board of directors in recommending the authorization of an increase in capital stock from $80,000,000 to $100,000,000 were reported, and the latter recommendation was acted on formally.

SUMMARY OF FINANCIAL REPORT

Electric operating revenues		$43,107,955.71
Electric operating expenses (Including amortization and depreciation, $3,287,211.67)		28,418,946.77
Net electric operating revenues		$14,689,008.94
Other charges:		
Uncollectible operating revenue	$165,147.46	
Taxes assignable to electric operations	3,400,000.00	
Municipal compensation	1,283,883.12	4,849,030.58
Net operating income		$9,839,978.36
Other income		687,564.92
Gross income		$10,527,543.28
Deductions from gross income		1,202,946.50
Balance		$9,324,596.78
Interest on funded debt		3,048,222.01
Available for dividends		$6,276,374.77
Dividends paid		4,602,416.00
Balance carried to surplus		$1,673,958.77

Prosperous Year for Illinois Public Service

The annual report for the fiscal year ended Dec. 31, 1922, shows that both the operating revenue and the net income of the Public Service Company of Northern Illinois were substantially increased over 1921. With an increase in customers from 118,304 in 1921 to 133,600 in 1922, the gross operating revenues also increased from $12,213,315.93 to $13,712,094.90. Last year's net income available for dividends was $1,835,470.27 against $1,579,535.65 in 1921. The surplus for 1922, after deducting dividends, a depreciation account of $670,660 and other charges, amounted to $446,372.52, as against $275,262.65 in 1921. The company's total operating revenues from gas, electricity, heating and water service showed an increase of $1,498,778.97 over the year 1921. The report contains details of plant extensions, which are to include the new plant at Waukegan and 30,000-kw. additions at the Joliet station and a review of the new substations and transmission lines constructed during the year.

At the stockholders' meeting on Feb. 26 it was voted to increase the capital stock of the company by 50,000 shares of 6 per cent preferred stock, par value $100, and 100,000 additional shares of common stock without par value, to be on a parity in all respects with the present outstanding stock of the company. This will be issued as needed during the coming year.

Standard Gas & Electric Has Best Year

Figures given out by H. M. Byllesby & Company show that the Standard Gas & Electric Company in the twelve months ended Dec. 31, 1922, had the most successful year in its history. A preliminary earnings statement for the period indicates that the company had a balance of earnings of $1,386,457 after deduction of all expenses, interest charges, taxes, preferred dividends and amortization and other reserves. This is the equivalent of 13.07 per cent on the common stock of the company outstanding. In the previous year the balance for the common shares, after all charges, was $1,080,980, or 10.19 per cent.

New Trial Ordered

Litigation Between Southern Power Company and North Carolina Mills Sent Back to County

THE power-rate case in which North Carolina cotton mills are fighting the Southern Power Company, which has attracted great attention in that territory, was last week remanded by the Supreme Court of North Carolina to the Cleveland County (N. C.) court for retrial. This case hinges on the reasonableness of the rates prescribed by the North Carolina Corporation Commission, and the controversy started in November, 1920, when the power company applied to the commission for an increase of rates and abrogation of existing contracts and received permission to charge 1.25 cents a kilowatt-hour for primary power in the amount of 50,000 kw.-hr. a month, with an increasing or diminishing charge for less or greater amounts, and 1 cent for secondary power on the same basis.

A large number of cotton mills accepted the ruling of the commission, but appeals were taken to the county court by twenty-three of them, divided into three groups holding long-time contracts which had been set aside. One of these groups subsequently sought to withdraw from the suit, a mistrial resulted, and the case was brought before the Supreme Court. This body in ordering a retrial declared the appeal to it to be "fragmentary and premature," but went on record to the effect that the rate question involved is intrastate and not interstate, that no discrimination lies in the fact that the Southern Power Company may sell power cheaper in South Carolina than in North Carolina, and that there is no valid objection to the Corporation Commission's basis for rate fixing.

Ohioans Discuss Lighting Problems

Conservation of school children's eyesight is one of the greatest present-day illuminating engineering problems, according to Prof. H. B. Dates, Case School of Applied Science, Cleveland, who read a paper on public-school lighting before the new-business co-operations committee of the Ohio Electric Light Association at Columbus on Feb. 21. Although the average cost of good school lighting would not run over one-half of 1 per cent of the total school expenses, this expenditure would do much to allay defective vision in pupils, he said. He told of the installation of six units 16 in. in diameter in the 900-sq.ft. schoolrooms in Cleveland, where 150-watt bulbs are used. Professor Dates found this type of equipment to give the best average results with an intensity of 5 to 8 foot-candles.

Prof. F. C. Caldwell, Ohio State University, felt that more attention should be given to the esthetic values of school lighting.

Dr. M. Luckiesh of Cleveland lamented the fact that fixture designers are too ambitious in selling designs rather than the idea of illumination itself. With most of the present-day equipment copied after antique designs, he declared that there was not a single 1923 model which would serve effectively as an illuminating medium.

Progress in rural service was discussed by D. L. Gaskill, Greenville, who saw a growing tendency on the part of the farmer to prefer the minimum charge for service rather than a fixed charge added to the cost of energy at urban rates. This seems to be due to the fact that with the minimum charge the farmer can use as much energy as he desires, whereas the fixed charge leaves a doubt in his mind as to what kind of service he is paying for.

A meeting to adopt plans governing rural-line rates will be held in Columbus on March 29.

Hoover for Nitrate Production at Muscle Shoals

Secretary of Commerce Hoover, appearing recently before the appropriations committee of the House of Representatives, announced that he favored development of Muscle Shoals for making nitrates, although he was against government operation.

"I should like to see Mr. Ford do it if that would suit anybody," the Secretary said. "I do not know whether Mr. Ford's terms are the terms Congress ought to adopt. I could not speak as to that, but I would like to see anybody who has capital take Muscle Shoals and turn nitrates out of it tomorrow."

It was brought out that the United States has paid nearly $1,000,000,000 for Chilean nitrates since the Civil War, and the Secretary said that as a protective measure "we ought to do something for our own relief." He added that there was 4,000,000 hp. on the Colorado River in Arizona that he "would like to see turned into the manufacture of nitrates."

Public Relations Program for New England Men

Seven addresses bearing upon public relations are scheduled for a luncheon and afternoon meeting of the New England Division of the N. E. L. A. at the Hotel Vendome, Boston, March 8. The luncheon will be served promptly at 12:30, after which the following program will be carried out: "Public Relations in Theory and Practice," by R. H. Newcomb, executive assistant Boston & Maine Railroad; "Co-operation by and with Our Educational Institutions," by M. S. Sloan, president Brooklyn Edison Company; "Employees' Clubs," by H. T. Edgar, Stone & Webster; "Women's Public Information Committee," by Miss G. M. Thibodeau, Malden Electric Company; "Publicity," by C. L. Edgar, president Boston Edison Company; "Knowing Your Contractors and Dealers," by George W. Hurn, resident manager Haverhill Electric Company.

Nebraska Legislature Wants Ford to Develop Power

A resolution passed on Feb. 16 by the House of Representatives of Nebraska requested Henry Ford to make an industrial survey of the hydro-electric power of that state and to engage in its development, "pledging him the most cordial support from our government, state and municipal, and from our people." The resolution continued: "Resolved, That we urgently request the members of Congress from the State of Nebraska to support the passage of the Ford tender for Muscle Shoals before March 4, 1923, so that a precedent can be set for similar developments in Nebraska."

In response to this resolution United States Senator G. W. Norris, conspicuous for his opposition to the Ford proposal, sent a reply containing this among other statements:

"The resolution frankly states that the reason why you want the Nebraska members of Congress to support the Ford offer as to Muscle Shoals is 'so that a precedent can be set for similar developments in Nebraska.' The reason you give for the support of the Muscle Shoals proposition is one of the many reasons why I have been opposed to the acceptance of Mr. Ford's offer for Muscle Shoals. The acceptance of the Muscle Shoals offer, as you truly state in your resolution, would be a precedent which would be used as a basis for similar action all over the United States, and as a result we would give the control of the development of hydro-electric energy from our navigable streams over entirely to corporations of wealth without retaining any control or regulation whatsoever for the benefit of the people at large."

Wisconsin Utility Men Get Ready for Convention

Nearly a thousand public utility men are expected to gather in Milwaukee on March 21 to March 23, when for the first time in the history of Wisconsin electric light and power representatives will unite with street railway and gas company delegates in a convention to be held by the Wisconsin Utilities Association, founded a year ago. The joint session will be addressed by President J. P. Pulliam, Milwaukee; C. R. Phenicie of Green Bay, chairman of the Electrical Section; B. W. Arnold, Oshkosh, chairman of the Electric Railway Section; James P. Barnes of Louisville, Ky.; John B. Malig of New Haven, Ind., and others.

Subjects already arranged for the electrical sessions include the safety code, rural extensions, automatic substations and inductive co-ordination. The sales and accounting sections will hear W. T. Bracken, Beloit, on "Selling the Commercial Department to the Employees"; W. E. Derwent on "Manufacturers' Relations to the Sales Department," and Inman P. Marking on "Customers' Meter Reading."

New England Tie Lines

Hartford and Springfield Soon to Be United by a 66,000-Volt Line—Large Energy Contracts

RAPID progress toward the wider interconnection of New England central-station and power systems is under way notwithstanding the severe winter conditions lately experienced. One of the most important tie lines to be built in the near future will interconnect the South Meadow station of the Hartford (Conn.) Electric Light Company with the 66,000-volt system of the Turners Falls (Mass.) Power & Electric Company at Agawam. This line will also tie the plants of the Hartford company and the United Electric Light Company of Springfield, Mass., together. As the Turners Falls system is interconnected with the New England Power Company's system, and the latter with the Boston Edison and Narragansett (Providence) systems, and as the Hartford company is interconnected with the Connecticut Power and Connecticut Light & Power systems, the completion of the Hartford-Agawam line will close the gap between various central stations in southern New Hampshire, in Vermont, on the Atlantic seaboard and in central New England and the properties in southwest Connecticut, leaving Maine as the only New England state pursuing a policy of isolation in electrical generation and transmission.

Important contracts for the sale of energy have lately been closed in the eastern Massachusetts region involving either the enlargement of existing facilities or the provision of new supplies. The Eastern Massachusetts Street Railway has arranged to buy local energy from the Lynn Gas & Electric Company, and the Edison Electric Illuminating Company of Boston has agreed to supply 10,000 kw. to the Eastern Massachusetts Electric Company, instead of the previous 3,000 kw., the latter company operating a tie line between Revere, Malden and Salem, Mass., and serving various Tenney companies at the north of Boston. An interconnection will shortly be made between the Salem Electric Lighting Company and the plant of the Beverly Gas & Electric Company, recently acquired by the Tenney interests, with probable early curtailment of generating functions at the small and less efficient Beverly station.

At a recent hearing in the Boston Edison rate case it was stated that an investigation is being made by the Boston Edison company and the Boston Elevated Railway Company relative to the feasibility of purchasing Edison service in case the proposed electrification of the Shawmut branch of the New York, New Haven & Hartford Railroad is undertaken. Another interconnection about to be effected is between the Boston Edison system and the Cambridge (Mass.) Electric Light Company, with an initial supply of 3,000 kw. to the latter.

Europeans Impressed with Boston Lighting Bureau

So impressed were the members of the European "lighting mission" to the United States with the equipment and work of the Bureau for Better Illumination maintained in Boston that the establishment of an enterprise of this sort under the auspices of one or more technical societies in Great Britain will be taken up on the return of the vistors. The mission, which came to the United States late in January, is composed of W. E. Bush, British Thomson-Houston Company, London; H. Maisonneuve, Cie des Lampes, Paris; K. J. Corkery, China General Edison Company, Shanghai, and C. F. Johnston, International General Electric Company, London.

EUROPEAN LIGHTING MISSION VISITING IN BOSTON AND THEIR GUIDES

Left to right, front row—W. E. Bush, British Thomson-Houston Company; K. J. Corkery, Shanghai, China; H. F. Wallace, Boston; H. Maisonneuve, Paris. Back row—J. Danielson, Boston; H. H. Magdsick, Cleveland; G. L. Alexander, Schenectady.

Electricity in Southern Cotton Mills

MORE than 60 per cent of the cotton-mill spindles in the territory served by the Southern superpower system—and there are nearly fourteen million in that territory—are operated on purchased power, according to a survey made recently by J. E. Sirrine & Company, engineers, Charlotte, N. C. Another interesting thing is that 5,250,000 of these spindles are served by the Southern Power Company. The 8,369,300 spindles which are operated on purchased power are owned by five hundred mills having an annual energy consumption of 683,233,000 kw.-hr. and an indicated load of 296,625 kva. From 80 to 100 per cent of the power for spindles is sold on a primary basis, while from 4 to 20 per cent is sold when power is available.

SURVEY OF CONDITIONS ON SOUTHEASTERN SUPERPOWER SYSTEM, WHICH SUPPLIES POWER TO 8,369,300 COTTON SPINDLES
(Made by J. E. Sirrine & Company, Engineers, Charlotte, N. C.)

	Southern Power Company	Alabama Power Company	Georgia Railway and Power Company	Tennessee Electric Power Company	Columbus Power Company	Central Georgia Power Company	Carolina Power & Light Company and Yadkin River Power Company	All Others	Total Reported
Kva. installed:									
Hydro-electric	244,400	83,000	84,700	100,000	30,000	24,000	26,500	30,550	623,150
Steam	36,500	70,800	21,500	45,700	9,000	3,000	6,925	15,000	208,425
Kva. under construction:									
Hydro-electric	131,250	80,000	54,500	.....	.....	.....	.....	.....	265,750
Steam	56,250	.....	.....	15,000	.....	.....	.....	15,000	86,250
Economical undeveloped hydro power (kva.)	1,000,000	1,000,000	225,000	750,000	60,000	120,000	.....	60,000	3,125,000
Spindles in territory	8,922,500	1,434,624	1,045,000	125,656	838,496	385,664	1,098,280	.....	13,848,219
Mills buying power	271	39	20	46	33	20	59	12	500
Spindles on purchased power	5,250,000	850,000	389,220	113,568	650,000	227,312	859,200	30,000	8,369,300
Total kilowatt-hours sold in 1921	620,000,000	370,470,231	178,202,725	304,571,731	90,280,387	52,464,900	104,344,305	105,000,000	1,825,000,000
Total kilowatt-hours sold to cotton mills in 1921	421,000,000	60,195,542	48,964,350	10,468,398	60,355,729	17,327,730	56,922,043	25,000,000	683,233,000
Total indicated cotton-mill load on purchased power (kva.)	170,000	25,600	14,651	6,560	30,310	8,800	30,704	*10,000	296,625
Percentage on primary power	90	100	85	96	.....	80	95	80	90
Percentage on secondary power	10	.....	15	4	.....	20	5	20	10

Hell Gate Still Grows

A 35,000-Kw. Generator and a 35,000-Kva. Frequency Changer Will Augment Installation of 150,000 Kw.

WITH the placing in service on Feb. 3 of a fourth turbine at the Hell Gate station, the initial installation at the United Electric Light & Power Company's ultra-modern generating plant on the East River, New York, was completed. This made a total installed capacity of 150,000 kw., which is one-half of the 300,000 kw. ultimate capacity. Already it is found necessary to increase the equipment further, and in the fall of this year an additional 35,000-kw., 25-cycle unit will be added. This unit is similar in a general way to those of the same frequency now in service and is being supplied by the General Electric Company. It will operate at 1,500 r.p.m. and will supply energy at 11,400 volts. This turbine will be arranged to bleed steam at two points to heat the feed water through the use of closed heaters. It will exhaust into a 50,000-sq.ft. Worthington condenser of the same general type now in service on two of the units. To drive this turbine there will be installed three boilers of 15,500 sq.ft. heating surface each, to be furnished by the Springfield Boiler Company. A change from the first installation of boilers furnished by this company has been made in the tube arrangement to allow for the addition of economizers. In the present installation a drop leg in the header allows for the superheater to be placed above the lower six rows of tubes. In the new installation the tube bank, instead of being twenty rows high, will be sixteen high with the superheater on top. A 13,824-sq.ft. economizer will be installed for each boiler. The economizers and the superheater are being furnished by the Power Specialty Company.

The stoker arrangement is also being changed from that of the original installation. The present boilers are each fired by two fourteen-retort, seventeen-tuyère stokers discharging into a central clinker-grinder pit. Each of the new boilers will be fired by a single fourteen-retort, thirty-three-tuyère stoker. The present sluicing arrangement of taking care of the ashes will be retained. These stokers are furnished by the same company that supplied the original installation, the American Engineering Company. Certain minor changes will be made in this new equipment as compared with the present installation, keeping pace with the advance in the art during the past year. For the new boilers it will be necessary to build another smokestack, the steel foundation for which has already been laid. The building was originally built for the complete installation of 300,000 kw., except that only that part of the electrical gallery was built which was necessary for the present equipment. This electrical gallery building at present consists of a service building at one end with four switch sections and one control gallery section. Each of the switch sections houses the switching equipment for one generator and twelve feeders. There will now be installed and equipped three more switch gallery sections of the same general design.

In order to make available the reserve generator capacity of the 60-cycle system for the 25-cycle system, and vice versa, a 25,000-kva. frequency changer has been purchased. This unit will run at 300 r.p.m. and will consist of one 60-cycle, 13,800-volt, three-phase alternator and a 25-cycle, 11,400-volt, three-phase alternator on a single shaft and with four bearings. On the same shaft will be installed a 25-cycle, 11,400-volt wound-rotor induction starting motor and a 115-kw., 250-volt direct-current exciter. A 17,000-kva., 14,000-volt, three-phase, 25-cycle transformer is connected between the stator of the 25-cycle unit and the rotor of the 60-cycle unit. This is the largest unit of its type that has been built, and its operation is looked forward to with interest. It is approximately large enough to act as reserve for the loss of the largest generator on either system. A separate building is being built to house this unit together with its transformers and oiling equipment.

A further addition to the equipment at Hell Gate station will consist of a bank of five three-phase, 12,000-kva. outdoor transformers which will be used to supply service to territory in Brooklyn and elsewhere.

Refunding Figures in February Financing

ELECTRIC light and power public utility issues of bonds and stocks during the month of February amounted to $57,811,600, representing an increase of more than 88 per cent over February, 1922, but a decrease of more than 19 per cent as compared with January of the present year. Two ten-million-dollar issues swelled the month's total, a large part of which was for the purpose of acquiring or redeeming stocks or bonds already outstanding. Only nine of the eighteen securities listed represent applications for strictly new capital. The rise in popularity of preferred stock, which was one of the features of the trend of financial affairs in 1922, is still apparent. Long-term securities continue to predominate, and the rate of return yielded the investor, 6.25 per cent, though higher than in January, is still low.

SECURITY ISSUES OF ELECTRIC SERVICE COMPANIES IN FEBRUARY

Name of Company	Amount of Issue	Period, Years	Class	Purpose	Interest Rate	Price	Per Cent Yield
Connecticut Light & Power Co.	$4,500,000	..	Cumulative preferred stock	To retire floating debt and for construction	7	100	7
Southern Indiana Gas & Electric Co.	1,000,000	24	First lien and refunding mortgage gold bonds, series B	Refunding and to reimburse for expenditures	6	92	6.65
Alabama Power Co.	4,700,000	28	First mortgage lien and refunding gold bonds	Additions, to retire floating debt and other purposes	5	89½	5.75
Ohio State Power Co.	290,000	12	First mortgage gold bonds of 1915	Construction	6	97½	6.30
Southern Minnesota Gas & Electric Co.	1,275,000	19	First lien and refunding mortgage gold bonds, series A, sinking fund	To retire bonds and reimburse for expenditures	6¼	98¼	6.60
Monongahela-West Penn Public Service Co.	6,770,000	5	First lien and refunding convertible gold bonds, series A	To retire bonds	6	97.89	6.50
Charlestown Gas & Electric Co. (Mass.)	200,000	20	First mortgage gold bonds, series A	Refunding	5	104½	4.65
Electric Bond & Share Co.	1,000,000	..	Cumulative preferred stock	General corporate purposes	6	97½	6.15
Pacific Gas & Electric Co.	10,000,000	30	First and refunding mortgage gold bonds, series C	Additions and extensions	5½	98½	5.60
St. Maurice Power Co. (Que.)	9,026,600	30	First mortgage sinking-fund gold bonds	Additions and extensions	6½	99½	6.55
Pennsylvania-Ohio Pwr. & Lt. Co.	1,000,000	..	Cumulative preferred stock	To reimburse company for property expenditures	7	93½	7.49
Lake Sunapee Power Co. (N. H.)	200,000	20	First mortgage sinking-fund gold bonds	Additions	6	94½	6.50
Oklahoma General Power Co.	1,000,000	29	First mortgage gold bonds, series A	Additions	6	92	6.23
Continental Gas & Electric Co.	2,000,000	25	Refunding mortgage bonds, series A	Additions and extensions	6	95	6.40
West Missouri Power Co.	1,350,000	20	First mortgage gold bonds, series of January, 1923	Refunding and new capital	6	98½	6.13
Philadelphia Co.	10,000,000	15	Convertible debenture gold bonds	Refunding	5½	92½	6.25
East Penn Electric Co.	2,500,000	30	First mortgage and refunding lien gold bonds	Additions	6	97	6.20
Indiana Service Corp.	1,000,000	27	First and refunding mortage gold bonds, series A	Additions and extensions	5	88¼	5.88
Total	$57,811,600						

Growth of Niagara Falls Power Company Continues

The annual report of the Niagara Falls Power Company puts its total output of electrical energy for 1922 at 2,252,248,525 kw.-hr., placing the company once more in first place among American power companies in production of electrical energy. This output compares with 1,855,120,000 kw.-hr. in 1921, when the company occupied second rank, and to its peak output of 2,328,326,000 kw.-hr. in 1920.

Earnings applicable to dividends after all charges including amortization were $2,394,407, an increase of $415,814 over 1921. There was no remarkable change in the current assets or liabilities as compared with 1921, the former being $6,789,174, an increase of $398,813 over the previous year, while current liabilities increased $282,757 to $1,831,379, leaving net liquid assets, as of Dec. 31, $4,957,789. Accumulated surplus amounted to $2,136,761.

During the year under the customer ownership plant the company sold to employees and consumers $3,664,300 7 per cent cumulative preferred stock.

The transforming station at Echota, which forms the center of the upper Niagara River power territory, was completed during the year and has a capacity of 200,000 kw. The new transmission line to Buffalo, which is carried across the Niagara River in two places on high steel towers, was also completed and the tunnel which is to supply water from the upper river has been bored through in full size for more than three-quarters of a mile. Other additions made to the plant during the year consist of three hydro-electric units, each of 70,000 kw. capacity, placed in the gorge of the lower river, which will be operated with water brought from the pool above the falls. It is expected that one of these units will be put into service in time for the seasonal peak load this coming autumn and the other two early in 1924.

Niagara Falls Power Tunnel Almost Completed

Official announcement has just been made that the pressure tunnel from Port Day to the edge of the high bank of the Niagara River at Niagara Falls, N. Y., is nearing completion. This tunnel will carry the water for the new extension to the power development of the Niagara Falls Power Company, and it is expected that water will be admitted by the first of April. The tunnel is believed to be the largest water-power tunnel ever constructed, and the company wishes to afford engineers an opportunity to inspect it before it is put into service. With the co-operation of the Read-Coddington Engineering Company, which is the contractor for the work, an opportunity will therefore be given to engineers to visit the tunnel at any time between March 20 and April 1. It is requested that those desiring to make this inspection will send their names to the Niagara Falls Power Company, mentioning the date on which they would like to visit the work.

Maryland Utilities Association Organized

Permanent organization of the Maryland Utilities Association has just been effected at Baltimore by a gathering of utility men numbering 170. Electrical, gas and water-supply men took part in the movement, which is designed for the interchange of ideas, discussion of problems and education of the public.

Officers of the new organization are as follows: President, Emory L. Coblentz, Frederick; vice-president, Charles O. Culver, Salisbury; secretary and treasurer, H. T. Connolly, Annapolis.

Chamber of Commerce Takes Vote on Trade Bodies

Trade associations were the subject of a referendum submitted to its membership on Tuesday of this week by the Chamber of Commerce of the United States. Organizations representing practically all industries and branches of commerce form an important part of the chamber's membership, and a "yes or no" vote was taken on whether because of "their numerous useful and important functions of obvious propriety" trade associations should exist for each important branch of industry and commerce and on various subsidiary propositions affecting their control and functions.

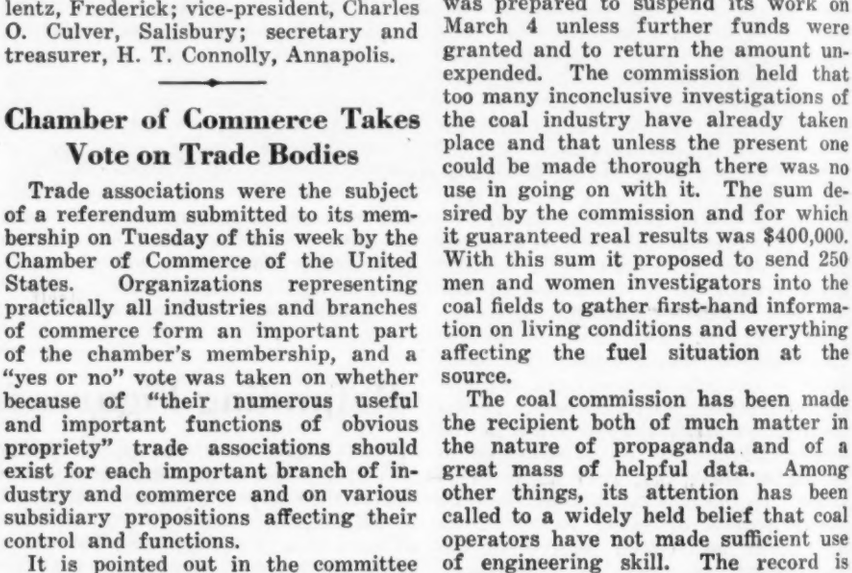
It is pointed out in the committee report accompanying the ballots that "there is a long list of functions which trade associations perform in the interest of their members and of the community at large. These functions are illustrated by the standardizing and safeguarding of the quality of goods, the reducing of waste in manufacture and distribution, the promotion of trade, both domestic and foreign, and the upbuilding in scores of other ways of industry and commerce." In its report the committee opposes government control of trade associations.

Coal Commission Asks More Funds to Finish Work

Although it still had $85,000 on hand, the President's fact-finding coal commission applied to Congress last week for a further appropriation, asserting that since the sum just named would be entirely inadequate to carry its investigations to a conclusion the commission was prepared to suspend its work on March 4 unless further funds were granted and to return the amount unexpended. The commission held that too many inconclusive investigations of the coal industry have already taken place and that unless the present one could be made thorough there was no use in going on with it. The sum desired by the commission and for which it guaranteed real results was $400,000. With this sum it proposed to send 250 men and women investigators into the coal fields to gather first-hand information on living conditions and everything affecting the fuel situation at the source.

The coal commission has been made the recipient both of much matter in the nature of propaganda and of a great mass of helpful data. Among other things, its attention has been called to a widely held belief that coal operators have not made sufficient use of engineering skill. The record is said to be clear that expenditures for engineering talent and advice represent an insignificant portion of the expense of coal-mine development—very much in contrast with the amount expended for engineers in metal mining.

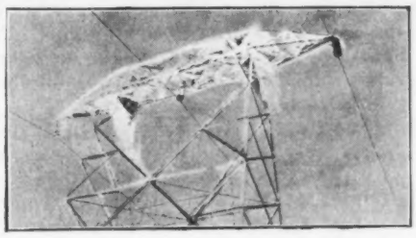
Lightning-Arrester Committee in Steinmetz's Workshop



Left to right—E. R. Seymour, L. T. Robinson, D. W. Roper, F. L. Hunt, M. G. Lloyd, J. B. Taylor, E. E. F. Creighton, J. R. McFarlin, V. E. Goodwin, A. H. Sweetnam, F. B. Davenport, W. F. Hudson, R. T. Wagner, A. H. Perham, J. P. Fish, H. H. Bailey, E. H. Burger, members of A. I. E. E. committee and General Electric officials.

Fog-Ice Deposit on Transmission Line Over Cascade Range

THE transmission line which Stone & Webster, Inc., are building across two mountain ranges to supply the Wenatchee Valley with power from the Puget Sound Power & Light Company's system is not yet complete, but some sections of the line have already withstood severe weather conditions. The accompanying picture was taken where the line crosses the Cascade Mountains at an elevation of 3,900 ft. A series of cold clear days last November were accompanied by moist winds blowing up from the lower canyons. When this moist air reached the cold zone at the higher elevations the moisture instantly congealed on contact with any solid object. The fog-ice hung from the conductor in icicles as long as 24 in. and several inches thick. When the picture was taken the ice had fallen from the conductors, but the peculiar formation of low-density ice on the tower can be plainly seen. The picture was furnished by W. D. Shannon, under whose supervision the line is being built.



FOG ICE ON TOP OF TRANSMISSION TOWER

Engineering Foundation Re-elects Rand Chairman

Announcement has been made by the board of directors of the Engineering Foundation, which is directing a national program of industrial research in co-operation with the National Research Council, of the re-election as chairman of Charles F. Rand of New York, who is treasurer of the American Institute of Mining and Metallurgical Engineers. Other officers elected are: First vice-president, Edward D. Adams; second vice-president, Frank B. Jewett; treasurer, Joseph Struthers; assistant treasurer, Henry A. Lardner.

Alfred D. Flinn was re-elected a director of the Foundation. Dr. W. F. M. Goss was elected to the board to succeed George M. Basford, and Col. Arthur S. Dwight was named a director to succeed Edwin Ludlow. Other members of the board for the ensuing year are George H. Pegram, Bancroft Gherardi, Silas H. Woodard, Prof. Arthur L. Walker, John H. Barr, H. Hobart Porter, David S. Jacobus, Prof. Herbert M. Boylston, E. Wilbur Rice, Jr., Elmer A. Sperry and J. Vipond Davies.

General Electric's New Plan for Employee Investment

To further investment by employees of the General Electric Company in the securities behind which the company stands a new plan has been worked out and the General Electric Employees' Securities Corporation has been organized. The new corporation will issue 6 per cent bonds to employees on the installment plan, paying an additional 2 per cent on them as long as the holder remains in the employ of the company. Seven of the fifteen members of the board of directors will be representatives of the employees, elected by the bondholders. Each $10 par value of such bonds of the new corporation will have one vote for these directors. Eight directors will be named by the company. The new corporation will issue $5,000,000 of 6 per cent fifty-year bonds and 10,000 shares of no-par-value capital stock. The proceeds from the sale of the stock and the bonds will be invested by the company in the securities of light and power companies and of holding companies in which the General Electric Company itself is financially interested. In other words, the idea of the investment trust will be followed, with the employees as participators in the profits through their holdings of the securities of the trust itself.

Brief News Notes

"Home Rule" for Fort Wayne Defeated.—The Indiana State Senate has defeated by a vote of thirty to thirteen a bill designed to remove from the jurisdiction of the Public Service Commission all utilities owned by the city of Fort Wayne, introduced at the request of the city officials.

St. Louis Bond Issue Carried.—St. Louis will soon enter into an era of physical transformation and development as a result of the voters' approval on Feb. 9 of twenty of the twenty-one proposed items of the municipal bond issue for civic improvement. The sum voted aggregates $87,372,500 and includes $8,000,000 for a city-wide electric lighting system.

"Home Rule" for Wisconsin Cities.—The judiciary committee of the Wisconsin State Senate has, without a dissenting vote, recommended for passage a bill calling for submission to the people of a proposed constitutional amendment to give all cities of the state home rule in the control of public utilities. The amendment has already passed one session of the Legislature and if again approved will be submitted to popular vote next year.

Annual Report of Metric Association.—At the recent annual meeting of the American Metric Association, held at the Massachusetts Institute of Technology on Dec. 30, 1922, and reported in ELECTRICAL WORLD for Jan. 6, page 59, the name of the association was changed to Metric Association. The report of the meeting has now been published and is procurable from the association's office at 156 Fifth Avenue, New York City.

Plant at Perryville (Mo.) Sold.—The electric light plant at Perryville, Mo., a town of 2,000 people, which has been operated under the outlying-plants division of the Union Electric Light & Power Company, has recently been sold to Felix B. and Preston T. Holcomb, who also own and operate the Pike County Electric Company at Bowling Green, Mo. The purchasers will increase the capacity of the Perryville plant from 50 kw. to 100 kw.

To Boost Washington Electrically.—Ambitious plans to make the nation's capital also the electrical industrial center of the country are being advocated by the Electrical Contractor-Dealers' Association of Washington. Interests representing an approximate investment of $100,000,000 are involved, and the announced plan is to have Washington's electric interests stand as a co-operative unit devoting its efforts to "electrifying America."

Another Pennsylvania Merger.—The Northwestern Electric Service Company of Pennsylvania, with headquarters at Erie, has acquired by merger the People's Incandescent Light Company of the same city as well as three electric railway companies—the Northwestern Pennsylvania Railway, the Northwestern Connecting Railway and the Crawford County Railways. The new consolidated company is capitalized at $2,000,000 and will supply light, heat and power as well as trolley service.

Proposed Tax of 10 per Cent on Oklahoma's Electrical Utilities.—A tax of 10 per cent on the gross receipts of all companies engaged in the transmission or sale of gas or electricity is one of the provisions of a measure to tax public utilities recommended to the Oklahoma Legislature by Governor Walton. Telegraph and telephone companies he would tax to the amount of 15 per cent and street railway companies 10 per cent. The California law which Governor Walton cites in support of his plan taxes electric and gas utilities only 7 per cent.

Muskogee Construction Proceeding Rapidly.—Construction work on the new Muskogee plant of the Oklahoma General Power Company is being rushed in order to complete the intake condensing-water tunnels before the spring rise of the Arkansas River. If these tunnels can be completed and ends walled in before this period, the completion of the entire project by Aug. 1 is assured. The excavation for the tunnels is about 35 per cent completed, according to George F. Phythian, construction superintendent, and construction work on the foundation about 25 per cent. The capacity of the new plant will be 22,500 kw., divided between a 15,000-kw. and a 7,500-kw. unit. The 15,000-kw. unit will have a condenser cooling surface of 31,000 sq.ft., with a pump capacity of 40,000 gal. of water per minute.

Municipal Plant Reduces Rates.—A flat reduction of 20 per cent in the rate for electrical energy supplied to Bellefontaine, Ohio, by the municipal plant has been authorized by the City Council, effective March 1. The new rate for lighting purposes will be 8 cents flat; for power, a sliding scale from 5 cents down to 3 cents, with the 10 per cent discount for payment before the tenth of the month retained. The reduction was authorized after the report showed that the plant could be operated at a profit on these rates, based on earnings in 1922.

Cedar Falls Turbine Shows High Efficiency.—Tests on the 20,000-hp. Pelton single-overhung reaction turbine at the Cedar Falls extension plant of the city of Seattle have just been completed. This plant was placed in service in June, 1921, but for reasons beyond the control of either the city or the manufacturer final testing was delayed until a week or two ago. Notwithstanding that it has been in service for more than a year and a half, the unit was found to be in perfect operating condition, the absence of vibration being particularly noticeable. Water measurements were made by a weir installed permanently as a part of the power-plant equipment. A very satisfactory efficiency curve was obtained, the maximum exceeding 92 per cent.

A Memorial to Niagara Power.—City Engineer W. B. Bennett of Niagara Falls has advanced the idea that a suitable power memorial should be built on the state reservation at Niagara Falls to portray to the millions of visitors that come there yearly the importance of the hydro-electrical development now under construction. It is proposed to erect a duplicate of a section of the big water tunnel which the Niagara Falls Power Company is carrying a mile under the city of Niagara Falls. This tunnel reproduction would be about 100 ft. long, 32 ft. high and 32 ft. wide across the horseshoe, the height and width of the actual tunnel. The face of the memorial would be ornamental, representing the face of a cliff, but inside the tunnel would be lined in the same manner as the real one. The plan is to lead one of the reservation roadways into the model tunnel so that tourists could drive through it.

H. P. Davis Has Broadcasting Plan.—H. P. Davis, vice-president of the Westinghouse Electric & Manufacturing Company, who has been called the "father of broadcasting," has suggested a plan for the establishment of a national broadcasting service. He thinks that a federal regulating body should be formed along public service commission lines, and that two classes of broadcasting stations should be recognized—national and local. In the first class Mr. Davis would include a limited number of stations of considerable power with wave lengths arranged so that they will not interfere at any point and located where program material will always be available. These stations could transmit on the present wave lengths of 360 m. or 400 m. and also on a wave length that can be relayed. To the local stations should be given wave bands that will permit existing receiving apparatus to tune in on them, but these wave bands should be separated sufficiently from the national stations to allow no interference.

Los Angeles Utility's Earnings Increase 31 per Cent in 1922.—In a report to stockholders just issued by the Pacific Lighting Corporation, of which the Los Angeles Gas & Electric Company is a subsidiary, an increase in electric sales in 1922 of 31.1 per cent over 1921 is shown. During the year there was a net gain in electric meters of 12,875 and 487 miles of wire was added to the system. The large increase in both the gas and electric departments necessitated large additions to the manufacturing and distribution systems. The net capital expenditures amounted to $10,908,476. The Pacific Lighting Corporation at the end of the year had neither a floating nor a bonded debt. The Los Angeles Gas & Electric Corporation had a net bonded debt of $23,905,500, an increase for the year of $6,937,500. It had floating liabilities, practically all of which were for current items, of $2,405,931, and had current assets amounting to $3,573,499. On the same date there were cash and bonds in its sinking funds amounting to $1,059,912.

Associations and Societies

Middle West Division, N. E. L. A.—The annual convention of this geographic division has been set for St. Louis April 11 and 12.

Canadian Electrical Association.—This association will meet for its thirty-third annual convention at the Mount Royal Hotel, Montreal, on June 20.

American Electrochemical Society.—H. W. Gilette of the United States Bureau of Mines will give a talk on "The Electric Furnace in Non-ferrous Metallurgy" at the meeting of the Pittsburgh Section of the American Electrochemical Society on Thursday evening, March 8.

Missouri Men to Hold Convention on River.—The Missouri Association of Public Utilities will hold its next convention on May 24-26 on a Mississippi River steamboat starting from St. Louis at 8 p. m. May 23, going up the Mississippi and Illinois Rivers to a point above Peoria, Ill., and reaching St. Louis on the return trip at 5 p. m. May 26.

Columbus Forms Illuminating Section.—The first meeting of the newly formed Columbus Section of the Illuminating Engineering Society was held at the Engineers' Club on Feb. 20. Ward Harrison, president of the national organization, spoke. The officers of this section are: Chairman, G. F. Evans; secretary, R. C. Moore; members of the board, Prof. F. C. Caldwell, G. A. Sulzer and K. A. Piez.

Next Foreign Trade Convention to Be Held in New Orleans.—The tenth national foreign trade convention of the National Foreign Trade Council will be held this year in New Orleans on May 2 to May 4, according to official announcement. As in former years, leading foreign traders from every part of the United States and every line of industry, as well as a considerable number of business men from foreign countries, will be in attendance at the convention. The main theme of the convention will be "European Conditions as Relating to World Trade."

Southwestern Division, N. E. L. A.—Among the speakers scheduled for the convention of the Southwestern Geographic Division of the N. E. L. A., to be held at Oklahoma City on March 14 to 16, are Executive Manager Aylesworth and W. J. Canada, of N. E. L. A. headquarters; A. K. Baylor, chairman of the national wiring committee; Brig.-Gen. G. H. Harries, vice-president H. M. Byllesby & Company; J. W. Gleed, representing the Bell telephone interests; Earle W. Hodges of Arkansas, and possibly S. M. Kennedy, vice-president Southern California Edison Company. Governor Walton of Oklahoma will make the opening address.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See Jan. 6 issue, page 78, for latest list.]

Oklahoma Utilities Association—Oklahoma City, March 12-14. O. D. Hall, 1106 First National Bank Bldg., Oklahoma City.
Southwestern Division, N. E. L. A.—Oklahoma City, March 14-16. S. J. Ballinger, San Antonio Public Service Co., San Antonio, Tex.
Illinois State Electric Association—Chicago, March 14-15. R. V. Prather, 305 Mine Workers' Bldg., Springfield, Ill.
Wisconsin Utilities Association—Milwaukee, March 22-23. John N. Cadby, 445 Washington Bldg., Madison.
Tri-State Water and Light Association—Birmingham, April 17-20. W. F. Steiglitz, Columbia, S. C.
American Physical Society—Washington, April 21. D. C. Miller, Case School of Applied Science, Cleveland.
American Institute of Electrical Engineers—Spring convention, Pittsburgh, April 24-26; annual convention, Swampscott, Mass., June 25-29; Pacific Coast convention, Del Monte, Cal., Sept. 25-28. F. L. Hutchinson, 33 West 39th St., New York.
Middle West Division, N. E. L. A.—St. Louis, April 11-12. H. M. Davis, Bankers' Life Bldg., Lincoln.
American Electrochemical Society—New York, May 3-5. Colin G. Fink, Columbia University, New York.
Southwestern Public Service Association—Fort Worth, Tex., May 15-17. E. N. Willis, 403 Slaughter Bldg., Dallas, Tex.
Electrical Supply Jobbers' Association—Executive committee and general meeting, Hot Springs, Va., May 21-25. Franklin Overbagh, 411 S. Clinton St., Chicago.
Missouri Association of Public Utilities—River boat from St. Louis to Peoria, May 24-26.
American Society of Mechanical Engineers—Montreal, May 28-31. C. W. Rice, 29 West 39th St., New York.
National Electric Light Association—New York, June 4-8. M. H. Aylesworth, 29 West 39th St., New York.
Electric Power Club—Hot Springs, Va., June 11-14. S. N. Clarkson, Kirby Bldg., Cleveland.
Pacific Coast Electrical Association—San Francisco, June 19-22. S. H. Taylor, 527 Rialto Bldg., San Francisco.
Canadian Electrical Association—Montreal, June 20. Louis Kon 65 McGill College Ave., Montreal.

Commission Rulings

Invasion of Territory.—Under this heading there was printed in this column last week an account of a dispute between the Morris & Somerset Electric Company and the Commonwealth Electric Company which was adjudicated by the Board of Public Utility Commissioners of New Jersey. By an inadvertence the facts of the case were just reversed. It was the Commonwealth Electric Company which brought the complaint against the Morris & Somerset Electric Company, the latter company being the one which had a contract with the Millburn Electric Company, and the decision of the utility commission was in favor of the Morris & Somerset company, the complaint of the Commonwealth company being dismissed. The trend of the commission's decision was correctly given.

Oregon Commission Orders Adoption of Parts of National Electrical Safety Code.—The Public Service Commission of Oregon has determined that "all rules previously adopted by it governing overhead and underground construction should be annulled and canceled, and that the 'Definitions of Special Terms' (Sec. 1), 'Rules Covering Methods of Protective Grounding' (Sec. 9), 'Rules for the Installation and Maintenance of Electrical Supply Stations and Equipment' (Part 1) and 'Rules for the Installation and Maintenance of Overhead and Underground Electrical Supply and Signal Lines' (Part 2) of the Electrical Safety Code are in all respects adequate, just and reasonable and should be adopted in lieu thereof." It has therefore ordered all public utilities within its jurisdiction which are affected by the sections of the code cited to comply with their provisions.

Close Account of Utility Expenditures Maintained by California Commission.—In line with its policy of keeping a close account of the expenditures of all public utility corporations in the state, the California Railroad Commission has ordered that utilities with a gross annual operating revenue of $100,000 or more shall report the names and titles of all officers or employees receiving a yearly salary of $5,000 or more, together with the amount of their expense accounts and any contingent fees and a statement of their duties. The same rule is applied to utilities whose gross income is between $25,000 and $100,000 except that the minimum salary to be reported is made $3,000. All utilities in these two classes must file a statement showing for each of the years 1920, 1921 and 1922 the total of donations, subscriptions and contributions of all kinds and the total payments to attorneys, both of said totals to be distributed to accounts as charged on the utilities' books during 1920, 1921 and 1922. In addition they are ordered to file a statement showing the amount of cash they had for all purposes on Dec. 31, 1922, the names of banks or other financial institutions with which such cash was deposited and the rate of interest received, and the amount of cash in the treasury.

No Universal Rule to Apply to "Going-Concern" Value.—Declaring that the "going-concern" value of every business and of every utility depends on the features of that particular utility, the Alabama Public Service Commission, in its recent valuation of the property of the Alabama Power Company, declared: "If it has cost the company nothing to produce its business, if it has no valuable organization of employees or established credit, if it has not gone to any expense in advertising, soliciting or demonstrating for the purpose of educating the public to the use of the company's facilities, its going-concern value is bound to be affected thereby. The commission cannot therefore accept as sound a percentage basis of arriving at the going-concern value of this company."

Falling Prices as They Affect Rates.—Denying a petition of the Central Illinois Light Company for increased gas rates, the Commerce Commission of Illinois said: "These are abnormal times and we are dealing with rates for the future. The commission must therefore take cognizance of the fact that since the filing of the application for increased rates there has been a material reduction in the price of commodities that enter into operating costs." Holding that, with the exception of fuel, the trend of operating costs for material and labor is downward, the commission went on: "Moreover, the burden of making up the losses brought about primarily by the world war ought not to fall wholly on the company's patrons; in other words, part of this loss ought to be borne by the company. . . . Present economic conditions are temporary, are constantly varying toward pre-war levels, and therefore it would be inexpedient to predicate rates thereon."

Getting at Value of Flowage Rights and Dam Site.—In its valuation of the property of the Wisconsin-Minnesota Light & Power Company to be taken over by the city of Rice Lake, Wis., and run as a municipal electric plant the Wisconsin Railroad Commission found the valuation of the water-power development, including dam site and flowage rights, one of extreme difficulty as the range of estimates was very wide and was further involved by the operation of storage reservoirs on the headwaters of the river. For the company, a total value of the water power, including storage and land, as high as $237,000 was claimed. The city engineer pointed out that it was assumed that the storage reservoir above Rice Lake would be entirely filled and emptied once a year and called this a very doubtful assumption. He also alleged an unsatisfactory condition of the dam. Rejecting a steam-plant comparison and using one based on oil-burning equipment, he arrived at a water-power value of $35,000, including flowage rights and dam site. On a basis of purchase of energy on transmission lines from another company he reached a value of $20,000. His final conclusion was that $30,000 was adequate for the water-power value, including flowage and dam site. The commission finally concluded that the water-power value, including flowage rights and dam site, should be placed at $55,000. Severance damages to the power company running from $12,000 to $15,000 were found proper by the commission.

Recent Court Decisions

Commission Order Requiring Installation of Water Meters Overruled.—In Elizabethtown Water Company vs. Board of Public Utility Commissioners of New Jersey an order of the board requiring the water company to install meters was overruled as unreasonable because, the court said, the undisputed evidence showed that the company was financially unable to purchase the meters and that it could not procure the necessary money. (119 At. 284.)*

Appeals from Oklahoma Commission.—Proceedings by the Quinton Relief Oil & Gas Company to review an order of the Corporation Commission of Oklahoma revoking without notice a former order have been dismissed by the Oklahoma Supreme Court on a question of procedure. The court points out that under the constitution and laws of the state appeals from commission proceedings must be taken in the same manner as appeals from district courts; i.e., by petition in error. (211 Pac. 493.)

Overflow Damages, Temporary or Permanent.—In Bennett vs. Louisville & Nashville Railroad Company, an action for damages because of the overflowing of crops through the alleged faulty construction of an embankment, the Court of Appeals of Kentucky found that whether temporary or permanent damages resulting from overflow are allowable is dependent on the nature of the structure causing it. If a permanent structure properly built, a single recovery in permanent damages is allowable; if intended as permanent and unlawfully or negligently built, or if a temporary structure, temporary damages are recoverable as injuries occur, the question of whether construction was negligent in any event being for the jury. Where the cost of repairs necessary to remedy negligent construction is in excess of any damage to the property involved, the court should instruct that such cost is unreasonable and permit damages for permanent injury. (246 S. W. 121.)

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men
Engaged in all Branches of the Electrical Industry

Medal for Lee de Forest

Dr. Lee de Forest, inventor of the audion or three-electrode vacuum tube for the amplifying of minute electrical currents and pressures, received the Elliott Cresson medal on Wednesday, Feb. 21, awarded to him by the Franklin Institute of the State of Pennsylvania. The presentation address was made by Dr. Walton Clark. A special committee, headed by Charles E. Bonine, appointed to investigate the audion reported that the invention of the three-electro vacuum is one of the most important ever made in the field of electrical transmission of intelligence and through its development has worked a profound revolution in the art of radio communication. Dr. Lee de Forest has been a pioneer in radio activity. He was born in Council Bluffs, Iowa., in 1873 and was graduated from the Sheffield Scientific School of Yale University in 1896.

C. A. Bigelow of Stone & Webster, Inc., has returned from Japan, where he has been associated with the Shogawa water-power development.

S. Barfoed, chief engineer for F. G. Baum, consulting hydro-electric engineer, San Francisco, is at present in Europe, visiting large hydro-electric developments.

H. S. Walker, former member of the sales force of the Denver office of the Westinghouse Electric & Manufacturing Company, has been transferred to the Salt Lake office of the company.

Col. Charles H. Tenney, of Charles H. Tenney & Company, Boston, was decorated with the distinguished service medal Feb. 21 at Springfield, Mass., by Assistant Secretary of War Wainwright, in recognition of his services in the Ordnance Department during the world war. The citation accompanying the decoration was read by Brig.-Gen. W. S. Pierce, assistant chief of ordnance, U. S. A.

Eugene A. Yates, who recently succeeded W. N. Walmsley as general manager of the Alabama Power Company, was elected vice-president and general manager of the company and was added to the board of directors at the annual meeting of the board held in Birmingham on Feb. 20. The following officers were re-elected: President, Thomas W. Martin; vice-presidents, R. A. Mitchell and W. N. Walmsley; treasurer, Robert M. MacLetchie, and secretary, Lamar Aldridge.

William McClellan and **Peter Junkersfeld,** consulting engineers of New York City, left on Saturday, Feb. 17, for Porto Rico to make final arrangements relative to the completion of the electric railroad which the firm has been building on the island. The railroad, which is virtually completed now, extends from San Juan to the outlying mountainous regions. In connection with this construction work Mr. McClellan made two previous trips to Porto Rico during the last few months. His present trip is partly one for rest.

C. T. Jones, formerly of the engineering department of the Northern Texas Traction Company at Fort Worth, is now in the engineering department of the El Paso Electric Company as distribution engineer.

William Q. Gallaher, formerly chief engineer for the West Virginia Public Service Commission, has taken charge of the "frigidaire" department of the H. & S. Electric Company in the Charleston district.

P. I. Robinson, formerly manager of the Fort Madison Electric Company, has been appointed manager of the Baton Rouge Electric Company, and Walter M. Bird, formerly of the Savannah Electric & Power Company, has been appointed manager of the Fort Madison Electric Company.

G. J. Newton, who has been associated recently with the Philadelphia Electric Company on underground distribution work, has joined the engineering department of the George Construction Company, Inc., of Philadelphia. Mr. Newton has been associated with underground distribution work for more than twenty years. He will have charge of the designing department.

James Orr has been appointed superintendent of power for the Hartford (Conn.) Electric Light Company, succeeding F. M. Wilbraham, who recently resigned the post to act as consulting engineer for the company. Mr. Orr has been in the company's service for more than a year, having previously been on the staff of Stone & Webster, Inc. Mr. Wilbraham is widely known in central-station power-plant circles and has been with the company many years.

John W. Carpenter of Dallas, vice-president and general manager of the Texas Power & Light Company, was recently appointed by Governor Neff to the board of regents of the new Texas Technological College. Mr. Carpenter is active in a widespread effort for the construction of cotton textile mills in Texas. He has made thorough studies of textile-mill conditions in New England and the Carolinas and has brought mill men to Texas to look over the situation, with the result that several such mills are now in process of organization, most of the proposed plants being designed to operate with central-station electric power.

F. D. Knight has been appointed superintendent of construction of the new power station of the Edison Electric Illuminating Company of Boston at Weymouth.

Charles P. Dunn, formerly connected with the city of Seattle's Skagit development in the capacity of hydraulic and structural designer, has become head of the drafting department of the Portland Railway, Light & Power Company.

George W. Saathoff, construction engineer for the Cities Service Company, which operates the Denver Gas & Electric Light Company, recently arrived in Boulder, Col., from New York, to inspect the site for the four-million-dollar steam plant which the Denver utility plans to erect near that city.

K. W. Kissick, chief engineer of the Sheridan County Electric Company for the past two and a half years, has been appointed manager of the Deming (N. M.) Ice & Electric Company, succeeding R. E. Thompson, who resigned to become manager of the Springfield (Mo.) Gas & Electric Company.

A. Strauch, formerly electric heating specialist for the Pacific Gas & Electric Company, has opened offices in the Rialto Building, San Francisco, as an electric heating engineer. Mr. Strauch was in charge of the development of electric heating and cooking for the Pacific Gas & Electric Company for eight years.

Obituary

Guilford S. Wood, president of the Southern Sierras Power Company, died recently. Mr. Wood was one of the original incorporators of the Nevada-California Electric Corporation, which is the parent company of the Southern Sierras Power Company.

Arthur M. Leacock was killed by gas on Thursday morning, Feb. 22, in a room occupied by him at the plant of A. M. Leacock & Company, manufacturers of electrical appliances. Mr. Leacock, who was president of the company, was accustomed to devote time in the evenings to the study of improvements on electrical appliances, using the room fitted up by him for that purpose. It is believed that when he entered the room he turned on the jets in a small gas heater but failed to ignite them.

Dr. John Trowbridge, professor of physics at Harvard University for many years and for twenty-two years director of the Jefferson Physical Laboratory in that institution, died at Cambridge, Mass., Feb. 18, at the age of seventy-nine. Professor Trowbridge became an assistant in mathematics at Harvard in 1866, was assistant professor of physics at the Massachusetts Institute of Technology 1869-70 and taught physics at Harvard from 1870 to 1910, when he was made professor emeritus and honorary director of the Jefferson Laboratory.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

Prices or Profits on Electric Ranges?

Lapse of Marsh Patents Will Not Change Market Conditions—The Opportunity Calls for "Quality" Goods and Prosperous Dealers, Not Cheap Ranges

By L. D. Smith
Secretary and General Manager Standard Electric Stove Company, Toledo, Ohio

THE twelve or fifteen years' experience I have had in the electrical cooking business inclines me to believe that all range manufacturers have tried to make their respective appliances as good as possible. Considering the magnitude of the undertaking and the resistance in the market, I think that the general acceptance of the electric range idea has made wonderful progress.

So far I presume that most observers will agree. But we now see an unwise and uninformed element coming into the business with the idea that the public can absorb a cheap electric range. Even some of the oldest of the present manufacturers are advising their trade to "wait and see what we are going to make for $99—something that every workingman can buy," and more along similar lines.

It happens that 54 per cent of our families have average incomes of $920 per year. I do not believe that these families can afford to use electricity for cooking purposes at any rate for which the lighting company can distribute it today, and to my way of thinking it would be an "unwise service" to the customer and an "unwise investment" to the lighting company to install an electric range in these homes on any easy-payment plan. Homes of this class too often have "wasteful ways," and the after-sale service alone would in too many cases be a hardship which the dealer could not long endure.

In giving the best service to a customer the customer's capacity to use the article should be considered. I see no present market possibility for a cheaply made electric range. Being cheaply made, it would quickly be out of order, it would consume more energy, bills would be higher and the user be correspondingly dissatisfied.

L. D. Smith

A user's dissatisfaction entails additional expense on the lighting company for service, repairs, apologies and out-of-use conditions, all involving again an increase in rates. I think the lighting companies have in the main been wise in guarding their users against the shoddy in electrical appliances and that it is supremely to their interest to discourage any attempts to dazzle the blind with poor quality electric ranges.

Market Is for Quality

If memory serves me rightly, about 20 per cent of American families have incomes of $3,000 to $10,000 per year, and it is to this class of families that the electric range makes its first appeal. These families include the thrifty, discriminating class, and when they buy they select carefully with an idea of permanency and beauty. They want the best and cleanest finish and the most durable construction. They never have absorbed and never will absorb the low-priced article. They are always buyers of the best and take the best care of it, prize it most highly and pay for its repairs.

The lighting company, the jobber and the dealer ought in self-protection to saturate this 20 per cent market with the best the most experienced manufacturers can make before they experiment with what might be done by some one "proceeding along new lines" with a low-price rainbow to catch the workingman demand. I take it that when this is done there will be time enough to sell ninety-nine-dollar ranges.

Profit Means More than Price

One need not disparage the ambitious gas-range manufacturer who finds his gas-stove business declining and wishes to go into a better thing. But up to date such advance as the electric range business has made was not made by him but in spite of him. He has not as yet merited the confidence of the electrical trade in any instance that we know of. If he can give the electrical public a convincing demonstration of better value, we certainly want it no matter who makes it; but we certainly do not want to load the public up with unsatisfactory appliances from any source. One must also remember that satisfaction to the user means many things. It means first a fair return to the manufacturer, a fair return to the distributing sales force and a full measure of return for the dealer service rendered. Otherwise none of these remain to render it and it is not given or received.

We are all here because each supplies, and has supplied, a want not possible to fill otherwise. The "Three Graces" cited above are just as essential to trade as faith, hope and charity are to morals, and I for one do not like to see one trying to strangle the other in the interest of low prices, or all gasping for breath in the interest of low prices on some gas-stove manufacturer's departure.

A "low-priced" range is an invitation to do business below cost. It encourages bad practice in the factory and poor service from the

dealers, who should be in a position to give the best. A poorly conceived electric range will be thrown back on the lighting company no matter who makes it. We have sufficient evidence of this in localities where the lighting companies have in previous years established cooking rates as low as 2 cents per kilowatt-hour in order to move them. In these localities the interest in and use of the electric range is not so great today as in many other localities where rates are 100 per cent higher. The lighting company must have a sufficient return from its range customers to justify the service they receive and must give a certain service not to be secured otherwise.

We have never urged a low rate in order to sell electric ranges. The range load is a profitable load to the light company, provided the range they install is a "bang-up," well-conceived and well-made article and installed in that class of homes that we classify as housing 20 per cent of our population. Something like four million ranges can find useful employment in these homes, and when all are filled and satisfactory service is rendered we can begin all over again. I should like to see the electric range become "class conscious" and the electrical trade united to discourage the efforts of any manufacturer who tries to make something competitive in price with gas or gasoline stoves.

PRICES OF RANGES SHOULD GO UP

A great many of the trade are under the impression that since the Marsh patent contracts have expired electric ranges will be considerably reduced in price. It must be remembered, however, that the licensers derived their income from royalties paid by manufacturers and they really were interested in a substantial remittance. The royalties depended on the sales and hence it appeared to be expedient to offer the user as low a price as was at all consistent in order to get the maximum royalty. Therefore, in the past, the jobber's margin of profit has been fixed very low. The dealer likewise was given a short discount and the manufacturers' lists were less than they should have been on a nominal volume.

The manufacturers who are selling at licensers' lists at regulated discounts have had no funds for publicity, the jobber has had no margin of profit for special sales work, and the dealer has not felt that his margin was sufficiently large to permit him to give reasonable service.

We do not know what action others are taking, but our list prices are being increased, and we feel that it is distinctly for the good of the range business.

The Gypsum Case as a Guide

Why This Decree Means Nothing to the Trade Association Member—A Simple Rule of Conduct for the Observance of Business Men

BY FRANZ NEILSON
Counsel Association of Electragists International

WIDE publicity has been given to the "consent" decree in the "gypsum case" under the mistaken belief that for the first time a concrete case has been decided in the courts furnishing a "yardstick" by which to judge just what can be done by trade associations and what cannot be done by them under the seemingly puzzling anti-trust laws. The district attorney in this case is credited with the remark that "this decree is a death knell to the trade association." On the other hand, Samuel Untermyer is reported to have said in effect that, so far from being the death knell of the trade associations, it marks the passing of the Sherman anti-trust law.

DECREE NO GUIDE WHATEVER

When doctors so eminent disagree what shall be done about it? For one thing, it may be well to recall a few fundamentals and do some thinking for ourselves to see whether or not it is all a tempest in a teapot. In the first place, there is no "decision" by any judge in this case. Decisions are rendered by the court on litigated questions of law or fact. Decisions deliberately arrived at on matters in dispute are entitled to great respect, especially when accompanied by opinions stating the important facts found and the conclusions of law. Counsel and laymen in other cases with similar facts will find such decisions helpful as indicating what rulings of law they may confidently expect in their own cases.

But this is a "consent" decree. It means nothing of any importance to any one save the parties to the suit. It means that the defendants agreed to submit to such decree without putting up any fight. It does not even mean that the judge who signed the decree gave it any thought. It is no guide whatever to other business men and trade associations unless the facts in their case are precisely like those in the gypsum case. If the decree represented a judgment following determined litigation on matters in dispute, it would be regarded as very significant and would become the leading case in anti-trust law questions. But it was not such a judgment. There was no litigation. The decree therefore constitutes no precedent whatever. In any new case to be adjudicated the court would proceed exactly as if there were no gypsum "consent" decree in existence.

The gypsum decree is thus, I repeat, of no help whatever as a guide. It represents an agreement between the gypsum people and the government as to what they will refrain from doing hereafter. It can have no application to any other trade unless that trade finds it is doing precisely what the gypsum people did and prefers to arrive at an agreement with the prosecuting authorities rather than to have any and all points in dispute adjudicated before the court.

The anti-trust laws are really not so puzzling to business men who have given thought to them. They merely prohibit "restraint of trade," which usually follows the fixing of prices, the maintaining of prices, the apportioning of territory among competitors, the allocating of customers to competitors, etc. The significance of such acts in connection with the interpretation of the laws had been pretty well grasped by lawyers and students of various decisions before the gypsum decree appeared. Ordinarily the business man who has given thought to this broad question is conscious of the true answer when a question of legality arises.

A RULE OF CONDUCT

My office long previously expressed a simple rule of conduct for members of trade associations desirous of

legitimately exchanging price information, to wit:

The members may meet, contribute, compile and publish facts, including past prices and other statistics; but there must not be any agreement or concert of action respecting prices to be charged, apportionment of territory, allocation of customers, punishment of competitors, limitation of output, etc. Each member by himself and uninfluenced by the others must arrive at his own conclusions from the facts he has received and decide for himself what he will do; and this without communicating his decision by word or sign to the others.

In other words, each member will use the information gained through the association in the same way that he uses information gained from all other sources, including trade reports in newspapers, gossip in the trade, salesmen's reports, confidential investigations, and so on.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

Farm-Lighting Plants Gaining Ground in Foreign Countries

The increasing amount of farm-lighting plant business being placed in foreign countries by manufacturers of the United States is shown in reports recently issued by the Bureau of Foreign and Domestic Commerce. On Feb. 26 the bureau issued a statement on the possibilities of these foreign markets and showed that certain South American countries, Australia, Mexico, Cuba, Java, the Straits Settlements, India and Ceylon are markets in which the farm-lighting plant is making considerable progress. As an indication of the volume of business done throughout the world, the total exports of farm-lighting sets from the United States during 1922 were valued at $441,569, of which $123,934 worth went to Australia, $1,727 to Brazil, $10,570 to Cuba, $27,658 to Mexico, $21,040 to Argentina, $14,851 to India, $7,811 to the Straits Settlements and $15,910 to Spain.

According to the survey made by the government officials, rural districts in many foreign countries offer increasing possibilities for the sale of the plants. Where the land is worked in large holdings, as in the case of sugar and rubber plantations, the demand is for isolated plants, which may range in capacity from ½ kw. to 50 kw. or even 100 kw. Where the rural districts are highly cultivated and thickly settled, there is a growing tendency to build distribution lines out from nearby central stations.

In connection with the successful marketing of farm-lighting plants abroad it is important that arrangements be made not only for aggressive representation but for a certain amount of service, especially where storage batteries are a part of the installation, according to government surveys.

Spotty Conduit Stocks Prevail

Nothing like well-rounded stocks of rigid conduit are reported at this time, and the farther one gets from the steel mills the more uneven the supply of pipe appears to be. In some places the shortage of both black and galvanized conduit in the ¾-in. to 1¼-in. sizes is very acute and few orders of substantial size can be filled without a lot of "shopping around" among jobbers.

Prices are firm as a result. The heavy traffic burden upon the railroads, combined with the large business the steel mills are handling in many lines, makes the early accumulation of reasonably complete stocks little more than a dream for the jobber far distant from the steel-producing centers.

The increasing popularity of pipe is a marked feature of the building revival of the past few months. There seems to be no immediate prospect of acquiring satisfactory stocks, but as the rigors of winter disappear improved deliveries by rail will unquestionably relieve the situation, to some degree, at least as regards the more pressing construction jobs.

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0303	$0.0296	$0.0247
Cold finished shafting, per lb.	0.0397	0.0378	0.0336
Brass rods, per lb.	0.1804	0.1742	0.155
Solder (half and half), per lb.	0.2617	0.2425	0.2075
Cotton waste, per lb.	0.1181	0.1175	0.106
Washers, cast iron (⅜-in.), per 100 lb.	4.33	4.33	3.83
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	2.96	2.96	3.11
Machine oil, per gal.	0.349	0.36	0.40
Belting, leather, medium, off list	49%	49%	46%
Machine bolts, up to 1-in. x 30-in., off list	51⅓%	51⅓%	64⅔%

Well-Sustained Demand for Motors

Absorption of Motors Into Diversified Industries Continues to Feature Current Business

Absorption of motors into diversified industries continues to feature current business, the demand being concentrated mainly into size ranges below 10 hp. At present motor stocks are substantial, although deliveries in the North are handicapped by railroad embargoes and highways obstructed by snow and ice. Competition is acute for the business available, and complaint is heard in some quarters that the margin between factory and list prices is unsatisfactory. There is also some discussion going the rounds relative to the granting of credits by manufacturers in territorial sales not directly negotiated by motor agencies, there still being some difficulty in assigning such credits under sharply competitive conditions.

The introduction of new motors into the market is also in evidence in some quarters, and the older lines are meeting this competition by increased attention to application engineering and to insistence upon high-grade construction. Some of these new motors have captured the business on the basis of one or two special features peculiar to their design, and at present the designing engineers of motor manufacturers generally are becoming more and more impressed with the demand of the user for maximum reliability of service. In the textile field sales have been gratifying, one manufacturer having recently received an order for 1,050 loom motors and one for 225 motors for the direct driving of carding machines.

NO SHORTAGE OF STEEL

No reports have been received of late as to shortages of steel, copper or insulating material used in motor construction, but under present railroad conditions factory purchasing agents are obliged to look well ahead in ordering raw material. The larger companies usually maintain stocks of steel adequate for all ordinary demands for motors. The tendency of raw-material costs is upward, and labor shortage in the unskilled and skilled fields alike is making some impression upon the industry. Prices of motors have not changed much lately, barring occasional cuts to move stocks under very sharp competition. This competition acts as a deterrent to sporadic price advances for the time being, but the feeling is far from local that the present volume of business is being done at a relatively low margin of profit. Therefore the price outlook is uncertain, with strong pressure on the buyer's side to hold orders subject to quotations at or near current levels, and, on the other hand, a pressure within the trade to realize more satisfactory margins of profit on the business in sight.

In well-informed circles it is believed that the unsaturated condition of industry as regards proper motor appli-

cations will stabilize production for a long time to come. An immense number of industrial and mercantile establishments remain to be equipped with suitable motor drives and collateral control equipment. This includes numerous installations which should be periodically analyzed from the standpoint of changing interior loads, modifications in load factor and power factor. Progressive motor-sales engineers realize that in the readaptation of drives toward wider use of individual motors on tools and other machines lies a field of exploitation which will be permanently useful to the industry and to the owner alike. The movement toward the substitution of alternating-current motors for direct-current units continues, and new applications of motors in paper manufacture, in the textile field and elsewhere are now featuring this important branch of the electrical industry.

The Metal Market

Active Demand Continuing to Force Prices Higher—Talk of Quotation Above 17 Cents

Active demand for copper is forcing prices higher, so that 16.37½ cents is quoted for electrolytic. Some producers are asking 16.50 cents. Domestic demand shows no signs of abating. Buying continues to be for prompt March and April shipment, and so far as can be learned is to meet requirements of business already booked or firmly in hand.

Owing to the sudden jumps in prices during the last few weeks, consumers have spent time trying to find

NEW YORK METAL MARKET PRICES

Copper	Feb. 20, 1923 Cents per Pound	Feb. 27, 1923 Cents per Pound
Electrolytic	15.12½	16.37½
Lead, Am. S. & R. price	8.00	8.00
Antimony	7.50	7.50
Nickel, ingot	30.00	30.00
Zinc, spot	7.05	7.20
Tin Straits	40.00	43.12½
Aluminum, 98 to 99 per cent.	23.00	24.00

16.25-cent copper, but are now paying 16.37½ cents freely, with some producers refusing such bids and demanding 16.50 cents. The price trend apparently is still upward. In fact, with most of the unsold copper available for shipment earlier than May in the hands of two or three agencies, there is considerable talk that the price will go above 17 cents a pound, delivered. Iron and steel scrap soared during the past week. Whereas a normal price rise is 25 cents a ton, the list moved up on an average of $1 a ton.

Copper and Brass Products

Copper, brass and bronze mills quote the following prices on brass and copper products:

Copper wire, prices upon application, mill; brass wire, 20.87½ to 22.50 cents; copper sheets, 23.75 cents; copper rods, 21 cents; brass rods, 18.62½ to 22.75 cents; sheet brass, 20.37½ to 22 cents.

Rocky Mountain Credits Better

Credit conditions in the Rocky Mountain region are improving, according to recent reports from Denver. Bankers in many of the small towns have taken a more liberal attitude in making loans. Electrical accounts in those places are with few exceptions considered good, although there is still a tendency by many contractors to pass their responsibilities along. The situation in the retail trade is improving.

No failures have been reported since the first of the year. Time payments on heavier appliances are being readily financed. Excepting in the dry land agricultural regions, electrical business is gaining through the amount of new building now under way.

The Week in Trade

Prices When Quoted Are Those Reported at the Opening of Business on Monday of This Week for Points West of the Mississippi River and on Tuesday for All Eastern Points

RISING prices in the copper market have caused considerable increases in the price of all wires, including some wiring devices. Shortages of steel in the East are said to be hindering manufacturers of heavier commodities, and deliveries are lengthened as a result. Appliances generally are selling steadily, and a slight spurt in heaters is still in evidence because of the colder and damper days of the last few weeks. Lamp sales are picking up gradually, and increased activity leading to larger volumes than for the corresponding period a year ago is expected by the jobbers. Collections throughout the country are improving.

Boston Greater activity in trade appears to be stimulating all lines. Many New England factories are now working on close to a war-time basis of production, although night operation is not yet general. Slow delivery of materials produced outside this section is the chief handicap to current business. Stocks are very low in steel products extensively used in electrical construction. Appliance sales are holding up well and much interest is evident in illumination. The labor situation here is relatively quiet at the moment. Interconnection of power systems is making rapid headway and there will be considerable construction activity in the transmission field this spring. Additional central-station capacity is being developed in various quarters. The general price trend is firm, but, notwithstanding shortages of some radio apparatus, prices in the retail field are weak.

New York Increased activities in manufacturing circles are reported in anticipation of unusually heavy buying during the summer and fall months. Steel-product deliveries are slower than a few months ago, and some manufacturers report that they are hard pressed in filling special orders. The higher copper prices have caused several markings up during the past week on wire, armored cable and some wiring devices. Most jobbers report that lamps are moving in larger volume, and this tendency is expected to increase greatly during the next two months. Conduit stocks continue to remain in a very low condition. Collections throughout the state are somewhat improved.

Baltimore Lamps are showing a falling off in considerable volume. The stocks to a large extent are very low. Considerable increase is noted in heaters and heating appliances in the past week, due to the coldest spell of the winter, but this is probably only momentary as the moderation of the weather has already caused a practical halt on this demand. Conditions in general are marking time, and jobbers are preparing for the expected rush of business with the opening of the spring season. Construction work has been retarded considerably in the past week owing to weather conditions. Interest is being taken in the coming "Better Homes Exhibition," at which all the jobbers will be represented with exhibits.

Pittsburgh Jobbers and manufacturers' representatives in this territory are reporting increased sales. This especially applies to steel commodities, such as armored cable, conduit boxes and fittings, and steel conduit, which includes various sizes of rubber-covered wires. Dealers report steady demand on appliances with good business on small construction jobs and repair work. The increased prices of conduit have not up to the present affected business to any considerable extent.

Atlanta The general tendency of the electrical trade is toward greater volume in almost every line, with conduit especially in heavy demand. The construction of office buildings and large apartments is cutting heavily into the stocks of jobbers, with the result that great difficulty is experienced in maintaining stocks. This shortage is general throughout the territory, and the price continues to climb. Jobbers and manufacturers of electrical generating equipment such as is required for small municipalities report business in this line the best for several years, with the prospects exceedingly bright for the spring and summer trade. Motor sales are ap-

Demand, Supply and Price Trend of Nineteen Commodities as Sold in Sixteen Cities

Explanation:
Demand: Steady, Slow or Active
Supply: Normal, Low or High
Price Trend: Firm, Decreasing or Increasing

Next Week
Reports will include
Instruments, Electric Ranges
and Hollow Ware

	Wire	Armored Cable	Conduit	Transformers	Poles	Pole Line Hardware	Porcelain	High Tension Equipment	Fuses	Meters	Switches	Wiring Devices	Lamps	Commercial Fixtures	Motors	Radio	Conduit Boxes	Signal Apparatus	Rectifiers
Boston																			
Demand	Act.	Act.	Act.	Sdy.	Slow	Slow	Act	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Act.	Sdy.	Act.
Supply	Nml.	Nml.	Low	Nml.	Low	Low	Low	Low	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Low
Price trend	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
New York																			
Demand	Act.	Act.	Sdy.	Sdy.	Slow	Slow	Sdy.	Act.	Act.	Sdy.	Sdy.	Act	Act	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.
Supply	Nml.	Hi.	Low	Nml.	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Low
Price trend	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Dec.	Firm	Firm	Firm
Baltimore																			
Demand	Act.	Slow	Act.	Sdy.	Slow	Slow	Sdy.	Slow	Act.	Slow	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Sdy.	Slow	Sdy.
Supply	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Low	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Firm	Firm	Firm
Atlanta																			
Demand	Act.	Act.	Act.	Sdy.	Act.	Act.	Act.	Slow	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Act.	Act.	Slow	Act.
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm
Pittsburgh																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Sdy.
Supply	Low	Nml.	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Cleveland																			
Demand	Act.	Act.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Sdy.	Act.	Sdy.	Act.	Act.	Sdy.	Sdy.
Supply	Nml.	Low	Low	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Chicago																			
Demand	Act.	Sdy.	Act.	Sdy	Act.	Slow	Slow	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Sdy.	Act.	Act.	Sdy.	Sdy.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Low
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
St. Paul-Minneap.																			
Demand	Act.	Slow	Sdy.	Sdy.	Act.	Slow	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Act.	Act.	Sdy.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm
St. Louis																			
Demand	Sdy.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Sdy.	Act.
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Low
Price trend	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
New Orleans																			
Demand	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Slow	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Slow	Sdy.	Act.	Sdy.
Supply	Low	Nml.	Low	Nml.	Low	Low	Nml.	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml.
Price trend	Inc.	Inc.	Inc.	Firm	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Firm
Denver																			
Demand	Act.	Act.	Act.	Slow	Act.	Act.	Sdy.	Slow	Act.	Slow	Sdy.	Act.	Sdy.	Act.	Slow	Act.	Act.	Slow	Sdy.
Supply	Nml.	Low	Low	Low	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Firm	Inc.	Firm	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Firm
Salt Lake City																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Slow	Act.	Sdy.	Slow	Sdy.	Sdy.	Sdy.	Act.	Act.	Slow	Sdy.	Act.	Sdy.	Slow
Supply	Low	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	Hi.	Nml.	Nml.	Nml.	Nml.	Nml.	Low
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Inc.	Inc.	Firm	Firm	Firm	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm
Portland-Seattle																			
Demand	Act.	Act.	Act.	Act.	Act.	Act.	Slow	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Act.	Act.	Sdy.	Slow
Supply	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.
Price trend	Inc.	Firm	Inc.	Firm	Inc.	Firm	Firm	Firm	Firm	Firm	Firm	Inc	Firm	Firm	Firm	Firm	Firm	Firm	Firm
San Francisco																			
Demand	Act.	Sdy.	Act.	Sdy.	Sdy.	Act.	Sdy.	Sdy.	Sdy.	Sdy.	Sdy.	Act.	Act.	Act.	Sdy.	Act.	Act.	Sdy.	Sdy.
Supply	Hi.	Nml.	Low	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Nml.	Low	Nml	Nml.	Nml.	Nml.	Low	Nml.	Nml.
Price trend	Firm	Firm	Firm	Firm	Firm	Firm	Dec.	Firm	Inc.	Firm	Inc.	Inc.	Firm	Dec.	Firm	Firm	Inc.	Firm	Firm

proximately 15 per cent in excess of those of the same period of last year, with the outlook for improvement within the next ninety days. Stocks have been maintained with fair satisfaction, although shipments are lengthening, quotations now being on the average of ten weeks.

St. Louis Business reports indicate that sales are remaining unusually good for this time of year in almost all lines. Retail trade has slackened to some extent owing to the cold weather. One of the light and power companies has announced plans for an extensive house-wiring campaign which will undoubtedly result in large sales of all materials used in this line of work, including fixtures and wall switches. The demand for radio equipment continues, stocks being spotty. Many of the industrial plants and the railroads are planning extensive electrical installations in the near future. Jobbers report a slight increase in price for alternating-current generating equipment.

Chicago With building construction for the first two months of 1923 averaging an increase of 100 per cent over the same period in 1922, the local demand for wiring material and devices is continuing briskly. Jobbers report increased activity in almost all staple lines. Prices are also stiffening, but there is a tendency to give more effort to obtaining deliveries than to worrying over prices. Winter trade in lamps is active. Radio equipment is selling well and supplies are fairly normal. The motor market is steadily advancing, the biggest volume being on motors ranging from 1 hp. to 10 hp., to be built into machine tools.

Cleveland Deliveries are greatly improved and stocks with but a few exceptions are recovered. A rising copper market has tended to make wire quotations higher, but no actual shortage is evident. Conduit is active and the supply is barely sufficient to allow quotations for future deliveries. Industrial equipment sales are in good volume, the week having brought a better movement in transformers, poles and pole-line hardware

Motors are not so active, although prices are firm, but high-tension equipment and porcelain are in better demand. Radio manufacturers have increased production and dealers are ordering consistently. Central-station business continues to improve.

St. Paul-Minneapolis Builders predict a banner year. The week's orders are reported smaller. Conduit supply is critical, and retail sales in the city are poor. Wiring is falling off slightly. Prices are firm but uncertain. All steel products show an upward tendency.

New Orleans With the approach of summer the electrical trade is already beginning to feel the slump in radio. New Orleans is one of the worst radio markets in the country because of the climate. The fact that there are no first-class broadcasting stations here makes the situation worse. With the lengthening days the market for electric bulbs is falling off. The difference in the consumption between summer and winter is about 25 per cent. Business in washing machines and suction cleaners is just hanging on. New Orleans is a very poor market for apparatus of this kind, principally because New Orleans women as a rule do not do their own housework and find it does not pay to intrust expensive apparatus of this kind to ignorant labor. A number of firms that made a specialty of washing machines and suction cleaners have gone out of business or changed their lines, and apparatus of this kind is now carried as a by-line only.

Denver Outside construction throughout the state is being held up by the weather. Local jobbers feel that the lull will permit replenishment of low stocks in certain lines, notably armored cable, conduit, rectifiers and special radio outfits. New orders placed by central stations throughout this territory for generating equipment indicate active market shortly for transmission materials. Considerable interest is developing in ornamental street-lighting systems, especially in the southern part of the state.

Portland-Seattle There has been a marked increase in inquiries regarding high-tension equipment during the past week, and the indications are that a considerable amount of this equipment will be installed throughout the Northwest this coming season. Many orders are reported for pole-line material. Bare copper wire is in active demand and the price trend is upward. The base rate advanced from 17½ cents to 18 cents per pound during the past week. The jobbing business continues to remain steady and better than a year ago. Competition is still keen in the contracting field, but there is a plentiful supply of large-sized contracts, and standard contractors generally are busy. Sales are slow for electrical dealers with the exception of radio material, which is very active.

San Francisco With the apparent end of the rainy season building has considerably increased, many sizable staple orders being reported. Retail trade in small appliances and supplies is noticeably better, while larger appliances, especially vacuum cleaners and sewing machines, are moving briskly. Time payment collections are in a slightly better condition than they were last year. Very few stock shortages have been reported during the winter. Rail service has been practically uninterrupted. Temporary shortages, such as in boxes and covers, caused by factory conditions are no longer serious. The demand for these is large and steady.

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Western Electric Sales Expected to Break Previous Records

Sales by the Western Electric Company for the year of 1923, it is officially predicted, will again break all records. The increase in production, based on orders now on the books, will amount to between 15 and 20 per cent over 1922. Sales for 1922 amounted to $210,900,000, surpassing the year 1920, the previous banner year, by $4,800,000.

Business during the last quarter of 1922 swept away all previous records. Orders received during that period aggregated $63,000,000, or about $5,000,000 more than sales for the same period in 1921.

At the close of business Dec. 31, 1922, there were $62,000,000 worth of unfilled orders on hand. A reflection of this kind of business shows itself in the Hawthorne apparatus schedules for 1923, which are now being prepared. In some cases these schedules have almost doubled and in all cases they have been materially increased.

Uehling Instrument Orders

Among very recent notable sales of Uehling CO_2 recording and indicating equipment are eight units for the Detroit Edison Company, making a total of sixty-five units purchased for the different plants of that company since 1911.

The River Rouge plant of the Ford Motor Company has also added two more units to its present Uehling equipment. This company has now a total of twenty-one units in operation. The application of this equipment to the River Rouge plant is of particular importance since the boilers are of unprecedentedly large size.

Organize New Jobbing Concern in Binghamton, N. Y.

Edwin C. Wehle, William H. Hecox and Harry A. Yetter are the directors of a jobbing concern known as the Southern New York Electrical Supply Corporation, 78 State Street, Binghamton, N. Y., which has been incorporated for $50,000. The corporation will have floor space of 10,000 sq.ft. Mr. Wehle recently resigned as president of the Southern Tier Electrical Supply Company of the same city and disposed of his interests in that concern in order to devote his entire time to the new supply company.

To Auction National Conduit Brass Plant March 9

Because the present scope of manufacturing operations of the National Conduit & Cable Company, Inc., under Receiver Clarence G. Galston, does not include the milling of sheet brass, the North plant of the Hastings-on-Hudson concern will be offered at receiver's auction sale, Friday, March 9, on the premises.

"This sale of the North (brass) plant of the National Conduit & Cable Company, Inc., will not affect the copper and cable plants of the company. Operations in these mills during receivership have been profitable and will be continued," declared Receiver Galston.

The North plant comprises ten acres, docks, buildings and equipment. The plant is served by a New York Central Railroad siding and has 1,400 ft. of deep-water bulkhead on the Hudson River. In all, there are fifteen brick and frame buildings, containing about 180,330 sq.ft. of floor space, fitted out with sprinkler system. In the material are five 3-ton traveling cranes.

Stevens & Wood, Inc., Acquire Wood Hulse Yates Company

Stevens & Wood, Inc., 120 Broadway, New York City, announce that the engineering and construction business formerly conducted by the Wood Hulse Yates Company, Inc., has been acquired with increased personnel. A general engineering and construction business will be conducted. Engineers will give personal attention to all engineering and construction work, including investigations, reports, appraisals, designs, purchase of materials and equipment for steam and hydro-electric power developments, transmission projects, railroad electrification, terminals and shop facilities, port and harbor works and industrial plants, and will supervise the financing, operation and management of utility and industrial properties.

Standard Electric Time Plans to Spend $65,000 on New Buildings

The Standard Electric Time Company, Springfield, Mass., plans additions to its plant in order to meet increased orders and also to provide facilities for introducing a new adaptation of its product. The buildings, for which about $65,000 will be expended, will include a wing for manufacturing, three stories in height, 88 ft. x 40 ft.; a one-story shipping room, 46 ft. x 46 ft., and a lumber storage shed, 21 ft. x 51 ft. Work will begin immediately. Orders are running one-third ahead of a year ago, officials of the company state.

Inland Glass Starts Production

The Inland Glass Company, 6101 West Sixty-fifth Street, Chicago, is a new manufacturing concern recently organized to manufacture a complete line of illuminating glassware for domestic, store, office, factory and street-lighting purposes. The production capacity of this company, according to officials, is $2,500,000 worth of glassware annually. Ground was broken for the new factory plant on Oct. 1, 1922, and production was started Feb. 19 last. J. B. Weaver, formerly vice-president in charge of production for the Pullman Car Company, is president; Noble B. Judah vice-president, and H. P. Withers secretary and treasurer.

New Agent for Wakefield Brass

The F. W. Wakefield Brass Company, Vermilion, Ohio, announces the appointment of the George A. Gray Company, San Francisco and Los Angeles, as its Pacific Coast representative for "Red Spot" hangers and other lighting specialties. Factory stocks will be carried in warehouses at 910 Howard Street, San Francisco, and 236 South San Pedro Street, Los Angeles.

American Flat Lite Organized to Take Corcoran Properties

The American Flat Lite Company, Cincinnati, has been organized to take over the properties of the T. J. Corcoran Lamp Company and the Corcoran-Victor Company, following the absorption of the latter company by the T. J. Corcoran Lamp Company. The company manufactures automobile and other lamps and has three large plants in Cincinnati. Thomas J. Corcoran is president.

Westinghouse Bookings Gain 25 per Cent

Bookings of the Westinghouse Electric & Manufacturing Company from Feb. 1 to 15 were 25 per cent ahead of the corresponding period of January. Orders taken were primarily industrial and supply goods with no unusual contracts. January showed the largest bookings of any month with one exception since the beginning of the fiscal year, April 1.

The Westinghouse company is meeting increased demands for power apparatus in mills. The outlook as forecast by the fourteen Westinghouse district sales managers in the United States for the six months from Feb. 1 is very encouraging. Eleven managers looked for increased business in their localities as compared with the previous six months. The forecast on Jan. 1 showed only six of the fourteen expecting larger business for the six months ahead.

Crescent Insulated Wire & Cable Arranging for Extensions

The Crescent Insulated Wire & Cable Company, Olden and Taylor Streets, Trenton, N. J., is arranging for extensions, to include the production of armored conduit wire, magnet and other wire. The company recently acquired the Crescent Armored Wire Company and will merge the business. A fund of $500,000 has been arranged to carry out the expansion. C. Edward Murry is president of the company.

The Connecticut Telephone & Electric Company, Meriden, Conn., manufacturer of radio apparatus, telephones and molded insulation, is planning to erect a new factory building just as soon as weather conditions will permit. It will be built of iron and concrete and will add much space to the company's present extensive plant.

The A. J. Bressan Company, 120 Liberty Street, New York City, announces that C. L. Hight, who acted for many years as sales representative and later manager of the New York office for Henry D. Sears, distributor of wiring devices, has associated himself with A. J. Bressan, head of the Bressan company. This company has recently been appointed New York representative for the Adapti Company, Cleveland.

The Berthold Electrical Manufacturing Company, Chicago, manufacturer of washing machines, has recently advanced E. L. Bennett from the position of sales manager to vice-president.

The Bates Expanded Steel Truss Company, Chicago, Ill., has completed plans for a new galvanized-steel-post plant to cost $100,000. The building will be erected on a site adjoining the present factory and work will be started early in the spring.

The American Electric Fusion Corporation, 92 Montana Street, Chicago, has broken ground in the block on Diversey Boulevard between Rockwell and Tallman Streets for a two-story plant, 80 ft. x 130 ft. It is said that this building will be under roof within sixty days and that other units will be completed before the end of the year, which will give this company a total of 60,000 sq.ft. of floor space. It was organized in September, 1920, by E. J. Henke, president, and others.

The Pure Carbon Company, Wellsville, N. Y., announces the recent establishment of an Alabama representative, the Commercial Electric Sales Company, 1322 Empire Building, Birmingham, Ala.

The Electroplax Company, Toronto, manufacturer of electric supplies, equipment, etc., will soon call for bids for the erection of a plant at Mount Dennis, Ont., to replace the one recently destroyed by fire. H. E. Cory is general manager of the company.

The Western Instrument Company, 1001 West Washington Boulevard, Chicago, has acquired a factory on Jefferson Street, south of Munroe Street.

The Morganthau Electric Company, 204 Market Street, Harrisburgh, Pa., manufacturer of motors, fans, etc., is planning the erection of a two-story factory, 80 ft. x 110 ft., to cost $90,000, including equipment. R. B. Thompson and L. A. Gable are officials of the company.

The Combustion Engineering Corporation, New York City, announces that T. J. Cleary, who recently opened an office in Atlanta for the sale of power plant equipment, has been appointed its Southern agent. Mr. Cleary has been a sales engineer in the South for many years.

The Moloney Electric Company of Canada, Ltd., Toronto, a subsidiary of the Moloney Electric Company, St. Louis, has been incorporated with a capital stock of $500,000 by George D. Y. Leacock, Richard W. Hart and others as provisional directors. It has purchased the tractor building of the Canadian Fairbanks-Morse Company, on Sterling Road, at a cost of $100,000, which will be equipped for the manufacture of transformers, electrical equipment, etc.

The Dudlo Manufacturing Company, Fort Wayne, Ind., manufacturer of electric coils, wire, etc., is arranging for the rebuilding of the portion of its enameling department, destroyed by fire Jan. 29. The loss was confined to one of the three buildings at the plant devoted to this service.

The Delta-Star Electric Company, 2437 Fulton Street, Chicago, has let a contract for a one-story plant, 103 ft. x 109 ft., to cost $40,000, for the manufacture of high-tension electrical products.

The Hamilton-Beach Company, Racine, Wis., manufacturer of electrical equipment, has plans for a three-story addition, 75 ft. x 385 ft., work on which will start about March 1. The investment in building and additional equipment will be approximately $240,000. F. J. Osius is general manager.

The Tri-City Electric Company, 16 Mechanic Street, Newark, N. J., jobber and manufacturer of electrical equipment, has leased a five-story building, totaling 30,000 sq.ft., and also a two-story rear structure at 52 Lafayette Street for a new plant. G. M. Ellis is president.

The New York Testing Laboratories, 80 Washington Street, New York City, have just installed a new automatic 100,000-lb. Tinius-Olsen testing machine, making their equipment one of the most up to date in New York City for handling tensile tests, compression tests and transverse tests.

Foreign Trade Notes

CATALOGS OF ELECTRICAL GOODS DESIRED IN CHILE. — C. A. McQueen, American commercial attache, Santiago, Chile, *Commerce Reports* states, is interested in receiving catalogs of electrical goods. The catalogs should be in Spanish if possible and should be sent in duplicate. If local representation has been provided for in Chile, it is suggested that each manufacturer note the name of its local agent.

A COMPANY ORGANIZED IN CHINA TO DEAL IN ELECTRICAL APPARATUS AND TO ENGAGE IN ENGINEERING WORK.—A company has been organized by David L. Anderson, 104 Consular Road, Tientsin, China, to engage in engineering and construction work and also in the merchandising of electrical products. The company proposes to act as agent to manufacturers of power and mining machinery particularly. Mr. Anderson is general manager of the company. Liang Shih Yi, head of a Chinese banking group, is chairman of board of directors.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

Purchase is desired in Switzerland (No. 5,511) for electric clippers and other barber supplies.

An agency is desired in Denmark (No. 5,513) for electric motors of all kinds and complete sawmill plants.

An agency and purchase is desired in Japan (No. 5,517) for wireless telephone apparatus and materials, etc.

Purchase is desired in China (No. 5,540) of two electrically driven centrifugal pumps, capable of delivering a minimum of 5,000 gal. of water to tank above main building, against a head of 150 ft., through a 3-in. pipe about 600 ft. long, and two electric motors to drive the above pumps.

Purchase is desired in Bolivia (No. 5,541) of radio-telephone instruments for communications up to 500 miles between cities at altitudes of 300 m. to 4,000 m.; telephones of the magnet system and switches for telephones.

Purchase is desired in Greece (No. 5,543) of power plant and supplies for city lighting, including turbine, regulator and generators.

Purchase is desired in Canada (No. 5,549) of gas producers of 200 hp. to 400 hp. for electric light plant.

An agency is desired in Greece (No. 5,574) for electrical accessories, batteries, generators and Diesel and semi-Diesel generating sets of from 1½ hp. to 40 hp.

The following inquiry has been received by the Philadelphia Commercial Museum, which will furnish names and addresses of the inquirers to any one desiring them and mentioning the number given: Parties in Kyoto, Japan (No. 40,540), would like to get in touch with manufacturers of small electric cars, motorcycles, etc., and would like to receive catalogs and descriptive matter pertaining to same.

New Apparatus and Publications

ELECTRIC DISHWASHING MACHINE. —The Colt's Patent Fire Arms Manufacturing Company, Hartford, Conn., has placed on the market a new dish, silver and glass washing machine for restaurants, known as model A "Autosan."

ECONOMIZER—Bulletin EC 100 issued by the Power Specialty Company, 111 Broadway, New York City, gives an outline of the use of the "Foster" economizer for recovering waste heat from boiler-flue gases.

LIFTING MAGNETS. — The Cutler-Hammer Manufacturing Company, Milwaukee, is distributing publication No. 3,015 covering the "C-H" lifting magnets. Special attention is called to the "Red" magnets, which are described and illustrated in this booklet.

PORTABLE AIR COMPRESSOR. — A portable air compressor, mounted on a standard Ford truck chassis, has been introduced by the Ingersoll-Rand Drill Company, 11 Broadway, New York City.

PORTABLE VENTILATOR. — The Ilg Electric Ventilating Company, 2850 North Crawford Avenue, Chicago, is distributing a folder describing its new portable "Ilgair" ventilator for household ventilation.

INDUSTRIAL LIGHTING UNIT. — The Ivanhoe-Regent Works of General Electric Company, Cleveland, has developed a new industrial lighting unit, known as "Glas-steel." It consists of a white porcelain-enameled steel reflector and a glass-inclosed diffusing bowl.

ASH CONVEYOR. — The Combustion Engineering Corporation, 43 Broad Street, New York City, is distributing a pamphlet entitled "Combusco Ash Conveyor," which describes its "Combusco" water-seal ash conveyor.

SIGNAL EQUIPMENT. — The Signal Engineering & Manufacturing Company, 533 Canal Street, New York City, is distributing a folder describing its signal and control equipment.

SELF-PRIMING PUMPS. — The Fulflo Specialties Company, Blanchester, Ohio, has added a ball-bearing, motor-driven pump of 75 gal. capacity to its line of "Fulflo" self-priming pumps.

INSTRUMENTS FOR RECORDING CONDENSER LEAKAGE. — Bulletin No. 1,222 issued by the Esterline-Angus Company, Indianapolis, Ind., describes its instruments for recording condenser leakage and indicating concentration of boiler water.

FLASHLIGHT.—A new flashlight with a 500-ft. range, known as the "Ever-Ready Focusing Searchlight," has been put on the market by the National Carbon Company, Inc., Thompson Avenue and Orton Street, Long Island City.

TOASTER.—The Terry Kitchen Device Company, 25 West Forty-third Street, New York City, has placed on the market an electric toaster for use in hotels, restaurants, etc.

ELECTRIC STOVES. — The Standard Electric Stove Company, Toledo, Ohio, has issued a catalog supplement and selling price list (twelfth edition) covering its products.

ELECTRIC HAMMER. — The National Electric Manufacturing Company, Inc., Pittsburgh, Pa., is distributing a folder describing its "Syntron" electric hammer.

TRAFFIC-CONTROL DEVICES.—"Traf-icons" is the title of a booklet issued by the Line Material Company, South Milwaukee, Wis., describing a new system of traffic-control devices.

PORTABLE REFLECTOR.—A new reflector, known as the portable reflector with extension, has been developed by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

GEARED UTILITY TOOL.—A new flexible-shaft geared utility tool ("Dumore") has recently been developed by the Wisconsin Electric Company, Racine, Wis.

OUTLET. — A new convenience outlet, known as the "Duplex," is being marketed by the Square D Company, Detroit. This outlet is rated at 10 amp., 250 volts, but the heavy current-carrying parts permit a current of 20 amp. without heating.

ELECTRIC BOILER.—Bastian & Allen, electrical engineers, 58 Haymarket, London, S.W.1, England, is distributing a leaflet describing and illustrating the Bastian & Allen electro-steam boiler.

REFLECTOR.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has developed a new mill-type reflector for use with the new mill-type B lamp in mills and factories.

THEATER LIGHTING.—"The Control of Lighting in Theaters" is the title of bulletin No. 28 issued by the Frank Adam Electric Company, St. Louis, in which an attempt has been made to give some standardized practice for lighting theaters.

New Incorporations

THE CACAPON ELECTRIC COMPANY, Martinsburg, W. Va., has been incorporated with a capital stock of $11,000 by Clarence E. Martin, Martinsburg; E. L. Coblentz, Frederick, Md., and M. F. Riley, Hagerstown, Md.

THE KIRBYVILLE (TEX.) ICE & LIGHT COMPANY has been granted a charter with a capital stock of $20,000. The incorporators are R. J. Cooper, J. M. Mixon and B. A. Woods.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

GARDINER, ME.—Steps have been taken by the Gardiner Board of Trade for the installation of an ornamental lighting system on Water Street and Depot Square.

RUTLAND, VT.—The city of Rutland has petitioned the State Legislature for permission to amend its character so as to allow the city to operate electric and gas plants.

SPRINGFIELD, VT.—The Vermont Hydro-Electric Corporation will made extensions at its hydro-electric power plant at Carvers Falls.

EAST BRAINTREE, MASS.—The East Braintree Bleacheries, Inc., will build a one-story power house in connection with an extension to its mill.

GLOUCESTER, MASS.—The Gloucester Electric Company will erect an addition to its power plant.

MIDDLEBORO, MASS.—At a recent town meeting the proposal to issue $31,000 in bonds for the construction of a hydro-electric plant at Muttock dam was carried.

WILBRAHAM, MASS.—At a town meeting held recently it was voted to extend the street-lighting system on several additional highways.

EAST GREENWICH, R. I.—Improvement to the street-lighting system on Main Street is under consideration by the Chamber of Commerce.

BETHLEHEM, CONN.—The Litchfield Electric Light & Power Company has begun work on the erection of an electric transmission line to Bethlehem to furnish electrical service here.

BRIDGEPORT, CONN. — The Jenkins Brothers Company will build a switch house for electric service at its valve-manufacturing plant. Motors and other electric power equipment will be installed in the proposed factory addition, to cost about $250,000.

HARTFORD, CONN.—The Connecticut Power Company, controlled by the Hartford Electric Light Company, is planning to erect a high-tension transmission line connecting its electric stations with those of Springfield and Turners Falls. It will also have connection with the hydro-electric plants on the Deerfield and Connecticut Rivers.

Middle Atlantic States

BATAVIA, N. Y.—In a report submitted to the City Council by Alvord, Burdick & Howson, engineers, changes and improvements to the municipal electric distribution system are recommended, involving an expenditure of about $10,000.

BROOKLYN, N. Y.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D.C., until March 13, for 80,000 ft. of incandescent lamp cord. (Schedule 551.)

BUFFALO, N. Y.—The City Council has adopted a resolution authorizing the gas lamps along Fillmore Avenue for several miles to be replaced with luminous electric arc lamps.

BUFFALO, N. Y.—The Niagara, Lockport & Ontario Power Company has petitioned the Public Service Commission for permission to issue 19,685 shares of stock of no par value, to be sold at not less than $40 per share, the proceeds of at least $407,400 to be used for the purpose of acquiring 916,865 acres of land in the towns of Lewiston and Niagara and in the city of Niagara Falls, owned by the Lower Niagara Power & Water Supply Company.

HADLEY, N. Y.—The electric plant of the Hadley Light & Power Company has been purchased by M. B. Riddle of the Riddle Light & Power Company, Luzerne.

KINGSTON, N. Y.—The installation of a new street-lighting system is under consideration. The Kingston Gas & Electric Company furnishes the street-lighting service.

YONKERS, N. Y.—The installation of a new street-lighting system in the business district is under consideration.

BAYONNE, N. J.—The Ingram-Richardson Manufacturing Company, Beaver Falls, Pa., will build a power house in connection with its proposed local plant, to cost about $85,000.

CAMDEN, N. J. — The Public Service Electric Company has been awarded a contract to supply electricity for the new pumping stations for the Camden City Water Department. Each pump will have a capacity of 1,000 gal. per minute.

CAMDEN, N. J.—Steps have been taken by the Kaighn Avenue Merchants' Association for the installation of an improved lighting system on that thoroughfare.

EAST ORANGE, N. J.—The City Council is considering the replacement of the gas lamps on Main Street, Central, Springdale and Fourth Avenues and Harrison and Washington Places with electric lamps. Electric lamps will also be installed in the vicinity of the Lackawanna bridges. The cost of the work is estimated at about $100,000.

PATERSON, N. J.—The North Main Street Business Men's Association has petitioned the City Council for the installation of about twenty-five additional ornamental lamps on North Main Street.

HAZLETON, PA.—The Jeddo-Highland Coal Company plans to rebuild its power house at its No. 2 Highland Colliery, recently damaged by fire, with a loss of about $17,000.

PHILADELPHIA, PA.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 13 for 25,000 ft. single-conductor high-tension ignition cable. (Schedule 553.)

PITTSBURGH, PA.—The Fort Duquesne Laundry Company will build a power house at its plant at 129 Fortieth Street.

POTTSVILLE, PA.—An electrically operated pumping plant will be installed in connection with a sewage-disposal plant, to cost about $1,000,000.

POTTSVILLE, PA.—The Eastern Penn Electric Company has been organized by the Eastern Pennsylvania Light, Heat & Power Company, Pottsville, as a subsidiary, to construct and operate electric generating plants and systems in Schuylkill County.

ABERDEEN, MD.—The Maryland Finishing Company will build a power house in connection with its proposed local plant, to cost about $30,000.

ANNAPOLIS, MD.—Bids will be taken at once by the Supply Officer, United States Navy Department, for 20,000 ft. of cable. (Requisition 65.)

HAVRE DE GRACE, MD.—The Havre de Grace Electric Company has issued $90,000 in bonds, part of the proceeds to be used for extensions and improvements.

BLUEFIELD, W. VA.—The Pond Creek Pocahontas Company, recently organized to operate coal properties in McDowell County, plans to install a power house in connection with an electrically operated coal-mining plant. T. B. Davis is president.

HUBBELL, W. VA. — The Huntington Gas & Development Company is planning to rebuild its power house and lubricating works, recently damaged by fire. The loss is estimated at about $100,000.

LOGAN, W. VA.—The Guyan Machine Shops are making inquiries for an electric hoist with alternating-current motor; also for a motor-generator set, 100 kw. to 150 kw., or a rotary alternator of same capacity.

DANVILLE, VA.—The Danville Traction & Power Company has entered into a ten-year contract with the city of Danville for the purchase of energy from the municipal electric light plant, the service to begin July 1. The traction company will install a rotary converter in the municipal plant.

NORFOLK, VA.—Plans for the proposed local sugar refinery to be erected by Adolph Segal, Philadelphia, and associates, to cost about $4,000,000, include a power plant. Charles B. Hughes, president Hughes-Ellis-Howell Corporation, 403 Boush Street, Norfolk, is interested in the project.

STRASBURG, VA.—The Town Council has awarded the Northern Virginia Power Company, Winchester, a franchise to furnish electricity here.

SUFFOLK, VA.—The Instant Collapsible Rim Company, Bank of Commerce Building, Norfolk, contemplates the construction of a substation at its proposed local plant.

WASHINGTON, D. C. — The Potomac Electric Company contemplates the erection of an office building and garage at 13½ and C Streets, N. W., to cost about $200,000. The Milburn-Heister Company, 710 Fourteenth Street, N. W., is architect.

North Central States

ALMA, MICH.—The property of the Central Michigan Light & Power Company has been sold to the Consumers' Power Company, Jackson. The Central company supplies electrical service in cities and towns in Clare, Isabella and Gratiot Counties.

DETROIT, MICH.—The Père Marquette Railroad Company plans to install electrical equipment and an addition to its power house in connection with improvements at its shops on Twelfth Street, Detroit, and at Grand Rapids, to cost about $1,200,000 and $1,500,000, respectively. An electric block system from Alexis to Carleton is also under consideration, to cost about $100,000.

JACKSON, MICH.—Plans are being considered by the Commonwealth Power, Railway & Light Company for extensions in Michigan, to cost about $9,000,000. The proposed work includes a 30,000-hp. steam-driven plant on the Saginaw River, between Saginaw and Bay City; a 12,000-hp. hydro-electric development on the Au Sable River at Alcona, and a 20,000-hp. plant on the Manistee River.

CINCINNATI, OHIO.—Surveys are being made of the electric power requirements of the southern Ohio district by the Union Gas & Electric Company. Tentative plans, it is said, are to erect an electric generating plant in the West Virginia coal fields, to cost about $25,000,000.

CLEVELAND, OHIO.—Bids will be received at the office of the Commissioner of Purchases and Supplies, City Hall, until March 10 for furnishing X-ray equipment for the new city hospital.

CLEVELAND, OHIO.—Plans are being prepared by the Cleveland Electric Illuminating Company for an electric boosting station at North Woodland Road and East 130th Street, to cost about $50,000.

CLEVELAND, OHIO. — The Cleveland (Ohio) Electric Illuminating Company, it is reported, contemplates taking over the power house of the Lake Shore Electric Railroad Company in Avon Beach Park, east of Lorain.

GIRARD, OHIO. — The proposed new street-lighting contract with the Pennsylvania-Ohio Power & Light Company calls for forty-three lamps of 100 cp., 127 lamps of 250 cp. and twelve lamps of 400 cp. At present there are only eighty-seven street lamps in operation.

HURON, OHIO. — The trustees of the municipal electric light plant are negotiating with the Sandusky Gas & Electric Company to furnish electricity in Huron, as the municipal plant is not self-sustaining.

PORT CLINTON, OHIO.—The American Gypsum Company will install electric power equipment in connection with its proposed plant addition, to cost about $100,000.

SOUTH BEND, IND.—Plans are being considered for replacing the sixty-four gas lamps now in use in River Park with electric lamps at the expiration of the present contract, which expires April 30.

SOUTH BEND, IND.—Work will soon begin on the erection of a power plant, in connection with a new five-story hospital to be erected at 123 West Navarra Street, by the Methodist Hospital Association. Schmidt, Garden & Martin, 104 South Michigan Avenue, Chicago, are architects.

CHICAGO, ILL.—Upon the rejection of the third bid for the installation of 14,000 municipal electric street lamps, George E. Carlson, Commissioner of Gas and Electricity, has announced that the city will install the lamps.

KEWANEE, ILL. — The Consolidated Light & Power Company has submitted a proposal to the City Council offering to sell its plant to the city. Bonds to the amount of $125,000 have been voted for the installation of a municipal electric plant.

MILWAUKEE, WIS. — The Milwaukee-Western Electric Railway Company, 253 Third Street, contemplates the construction of a new electric railway to Fox Point, via Juneau, Beaver Dam, and other towns, 65 miles long, to cost about $1,500,000.

MILWAUKEE, WIS. — The Milwaukee Electric Railway & Light Company has petitioned the Wisconsin Railroad Commission for permission to issue $3,000,000 in capital stock, the proceeds to be used for extensions to its electric light and power and street-railway service in Milwaukee and surrounding territory, including Whitefish Bay, Shorewood, North Milwaukee, Wauwatosa, West Allis, Cudahy and other towns.

OSHKOSH, WIS.—Plans have been prepared by the Water Department for additions to the waterworks pumping station, including the installation of three electrically operated pumps, to cost about $80,000.

SLAYTON, MINN.—Arrangements have been made by the Northwest Light & Power Company, Hutchison, to extend its transmission line from Pipestone to Slayton.

CEDAR RAPIDS, IOWA.—The Disbrow Sash & Door Company, Seventh Avenue, contemplates the erection of a power house, in connection with an addition to its plant to cost $80,000.

DUBUQUE, IOWA.—The Albert Emanuel Company, Inc., 61 Broadway, New York, has acquired the property of the Dubuque Electric Company and the Eastern Iowa Electric Company. Tentative plans are under consideration for extensions and improvements.

EAGLE GROVE, IOWA.—Electric power equipment will be installed in the proposed local ice-manufacturing plant, to be erected by the Iowa Cold Storage Company, Gilmere, to cost about $50,000.

OSKALOOSA, IOWA.—All work in connection with the proposed hydro-electric plant to be erected at Harvey by the city of Oskaloosa, we are informed, is in charge of Brown & Cook, Ottumwa, engineers. This is to correct an item published Jan. 27 stating that Burns & McDonnel, Interstate Building, Kansas City, Mo., were engineers.

SIOUX CITY, IOWA.—The Sioux City Brick & Tile Company, Third Street, will install electric power equipment in connection with the rebuilding of the portion of its plant recently damaged by fire. The loss is estimated at about $50,000.

KIRKSVILLE, MO.—The City Council has authorized a bond issue for $40,000 for extensions and improvements to the municipal electric plant. Black & Veatch, Mutual Building, Kansas City, Mo., are engineers.

SEDALIA, MO. — The West Missouri Power Company has issued $1,350,000 in bonds, part of the proceeds to be used for extensions and improvements.

SENECA, MO.—At an election to be held April 23 the proposal to issue $25,000 in light and power bonds will be submitted to the voters.

HOT SPRINGS, S. D.—Preparations are now being made for the installation of a new power plant at Sylvan Lake to replace the plant which was destroyed by fire last summer. The size of the plant depends upon the amount appropriated by the Legislature for state park requirements.

LINCOLN, NEB.—The Continental Gas & Electric Corporation has disposed of a bond issue of $2,000,000, part of the proceeds to be used for extensions and improvements to the system of the Lincoln Gas & Electric Company, recently acquired.

ONG, NEB. — The Electric Development Company, Omaha Loan & Building Association Building, Omaha, is planning to erect a transmission line to Ong, Shickley and vicinity, to cost about $28,000. Distributing systems will also be installed.

Southern States

BELMONT, N. C.—The Stowe Spinning Company contemplates extensions to its works, including the construction of a power house, to cost about $750,000.

BURGAW, N. C.—Bonds to the amount of $12,000 have been issued for the installation of an electric lighting and power system.

NORTH WILKESBORO, N. C. — The Wilkes Hosiery Mills Company plans to build a power house in connection with its proposed local mill, to cost about $75,000.

PINE BLUFF, N. C.—Electrically driven pumping machinery will be installed in connection with extensions and improvements to the waterworks system. Bids, it is understood, will soon be asked for equipment.

RALEIGH, N. C.—The Carolina Power & Light Company contemplates enlarging its substations at Goldsboro, Selma and at several other places.

ROCKINGHAM, N. C.—Plans for the proposed new textile mill be to be erected by the Leak Manufacturing Company, at a cost of about $500,000, provide for an electric power plant.

TAYLOR, S. C.—A steam-driven electric generating plant of 1,000 kw. capacity, will be erected at the proposed new mill of the Southern Bleachery Company. J. E. Sirrine & Company, Greenville, S. C., are architects and engineers.

ATLANTA, GA.—The George Railway & Power Company contemplates the erection of a susbtation on Walton Street.

MACON, GA.—Electric power equipment will be installed in the proposed ice-manufacturing and cold-storage plant to be erected by the Central Railway of Georgia, Savannah, to cost about $300,000.

ST. PETERSBURG, FLA.—The St. Petersburg Lighting Company contemplates extension and improvements to its system.

TALLAHASSEE, FLA.—The installation of an ornamental lighting system on Park Avenue, between Duval and Calhoun Streets is under consideration.

CHATTANOOGA, TENN.—The Southern Sheet Steel Company will build a power house in connection with its proposed new plant, near Glendale, to cost about $1,000,000.

LIVINGSTON, TENN.—The Cumberland Power Company contemplates extensions and improvements in the local electric system, recently acquired.

PIKEVILLE, TENN.—The Pocahontas & Sewanee Coal & Iron Company will install electric power equipment at its properties. The Williamson Construction Company, Pikeville, will make purchases.

LEEDS, ALA.—Preparations are being made by the Alabama Power Company, Birmingham, to erect a substation in Leeds, to cost about $1,000,000.

CLINTON, MISS.—Negotiations are under way between the Town Council and the Jackson (Miss.) Public Service Company whereby the latter may furnish electricity to operate the local system. If the project is carried through a twenty-four-hour service will be established.

MOSS POINT, MISS. — The Southern Paper Company will soon break ground for the construction of a power plant in connection with mill extensions, to cost $1,500,000.

NEW ALBANY, MISS.—Bonds to the amount of $25,000 have been issued for extensions and improvements to the municipal electric plant.

HOT SPRINGS, ARK.—Permission has been granted to the Caddo River Power & Irrigation Company to construct a hydro-electric project on the Caddo River, to cost about $5,000,000. The initial installation will develop about 15,000 hp. and will cost about $2,000,000.

DE QUINCY, LA.—Bids will be received by W. W. Tuck, president of the municipal waterworks, light and power board, until March 6 for construction of a municipal electric light plant and waterworks system. The equipment will include one 50-kw. and one 100-kw., three-phase, 50-cycle, 2,300-volt generator directly connected to oil engines, switchboard, motor-driven well pump, electric light and power distributing system, meters, transformers, etc. J. W. Billingsley, Interstate Bank Building, New Orleans, is consulting engineer.

ARDMORE, OKLA. — The Consumers' Light & Power Company will build a power plant to cost about $100,000. A cold-storage plant will also be erected.

CLINTON, OKLA.—At an election held recently the proposal to issue $45,000 in bonds for extensions to the municipal electric light plant and waterworks system was defeated. A new election will be held later.

CUSHING, OKLA.—The local plant of the Minnesota Electric Light & Power Company, Bemidji, Minn., was recently destroyed by fire, causing a loss of about $50,000. The plant, it is stated, will be rebuilt at once.

WYNNEWOOD, OKLA. — Bonds to the amount of $85,000 have been voted for extensions to the municipal electric light plant and waterworks system.

ABILENE, TEX.—The West Texas Utilities Company contemplates extending its transmission lines from Rotan to Roby.

BEAUMONT, TEX.—Arrangements are being made by the Eastern Texas Electric Company for extensions and improvements to its system, to cost about $150,000.

CUERO, TEX.—The Texas Central Power Company is planning to extend its high-tension transmission line to Kingsville and to furnish electrical service there.

HEMPHILL, TEX.—Plans are under way for rebuilding the electric light and power plant of the Temple Lumber Company, recently destroyed by fire. The loss is estimated at about $150,000.

HENRIETTA, TEX.—The City Council has entered into a contract with the Wichita (Tex.) Electric Company for the installation of seventy street lamps. In the business district 400-cp. lamps will be used and in the residential section 50 cp. will be installed.

VERNON, TEX.—The Texas Electric & Ice Company is preparing plans for the construction of an electrically operated ice-manufacturing plant in Vernon. Plants will be built at Bay City and Mount Pleasant.

VERNON, TEX.—The Vernon Electric & Ice Company has submitted a proposal to the City Commission offering to take over and operate the municipal waterworks and street-lighting systems. The city has authorized a bond issue of $100,000 for the installation of a municipal lighting system, but the project is tied up in litigation.

Pacific and Mountain States

OLYMPIA, WASH. — The proposal to extend the ornamental lighting system to take in Franklin Street and the cross streets from Fourth to Sixth Street has been approved by the City Council.

TACOMA, WASH.—The Wheeler-Osgood Company will install electric power equipment at its proposed new sash and door plant, to cost about $250,000.

YAKIMA, WASH.—The installation of an ornamental lighting system on Yakima Avenue from the railroad tracks to Twelfth Avenue is under consideration. The cost is estimated at about $8,000.

EUREKA, CAL.—Plans are under consideration for the installation of an ornamental lighting system in Seventh Street. H. H. Hannah is city engineer.

MARYSVILLE, CAL.—Plans are being considered for the installation of an ornamental lighting system in Fourth and Fifth Streets. W. M. Meek is city engineer.

SAN FRANCISCO, CAL.—Extensions are contemplated by the Market Street Railway Company, including a double-track line from Pacific City to San Mateo, to cost $150,000; double-track line from San Mateo to Beresford, $355,000, and the erection of substation, $30,000.

SAN PEDRO, CAL. — Plans are being prepared by the Pacific Coast Borax Company for an addition to its borax-refining plant, including machine shop, boiler house and generating plant, to cost about $75,000. A. C. Martin, Higgins Building, Los Angeles, is architect.

TURLOCK, CAL.—The Board of Trustees has granted the Turlock Irrigation District permission to install a distribution system to supply electricity for lamps and motors in the city.

WILLITS, CAL.—The Central Mendocino County Power Company will soon ask for bids for the erection of a transmission line to Potter Valley, 15 miles, to connect with the plant of the Mountain Water & Power Company. H. S. Tittle, 766 Folsom Street, San Francisco, is electrical engineer.

CALHAN, COL.—Plans have been prepared for a municipal electric plant and waterworks system, to cost about $50,000. The Brew & Sidow Engineering Company, Kitridge Building, Denver, is engineer.

DENVER, COL.—The City Council has adopted an ordinance permitting the Denver Gas & Electric Light Company to substitute Mazda lamps for street lighting for the arc lamps now in use.

FORT MORGAN, COL.—Work will soon begin on the construction of a new municipal electric plant.

TUCSON, ARIZ.—The Tucson Gas, Electric Light & Power Company contemplates extensions and improvements to its power plant and system, to cost about $300,000

Canada

POWELL RIVER, B. C.—Tenders are being asked on the first unit of a power plant to be erected at Power River for the Powell River Company, Ltd., Vancouver. Tenders will be received by N. R. Lang, manager, for a power house and smoke stack.

WINNIPEG, MAN.—Tenders will be received by the city clerk until March 15 for water-tube boilers and accessories.

MONKTON, ONT.—The Council is considering the installation of a hydro-electric plant and system.

NORWICH, ONT.—Bonds to the amount of $25,000 have been voted for the installation of an electric lighting and power system.

BAGOTVILLE, QUE.—Tenders, it is reported, will soon be asked by the Town Council for the construction of a municipal power plant to cost about $150,000.

DRUMMONDVILLE, QUE.—The Southern Canada Power Company, Montreal, is considering a 30,000-hp. hydro-electric development at Hemming's Falls on the St. Francis River, near Drummondville, this year.

MONTREAL, QUE.—Work has started on a hydro-electric development, to cost about $7,000,000, at St. Etienne des Gras, Quebec, for the Shawinigan Water & Power Company.

Electrical Patents

Announced by U. S. Patent Office

(Issued Feb. 6, 1923)

1,445,206. THERMIONIC RECTIFIER AND CIRCUITS THEREFOR; J. K. Elderkin, Newark, N. J. App. filed July 8, 1921. Storage-battery charging apparatus.

1,445,217. WINDING DEVICE FOR DROP-LIGHTS; C. V. Johnson, San Francisco, Cal. App. filed Sept. 25, 1918. Automatic coil winder for extension or trouble lights.

1,445,226. SEMI-AUTOMATIC TELEGRAPHIC SENDING MACHINE; H. G. Martin, Brooklyn, N. Y. App. filed Dec. 10, 1921. Simplified construction of the operating lever.

1,445,231. WELDING JIG; O. Muller, Jr., Ridgewood, N. Y. App. filed Sept. 19, 1919. For welding vacuum-tube electrodes.

1,445,233. TELEGRAPH SYSTEM; H. W. O'Neill, Brooklyn, N. Y. App. filed Nov. 19, 1919. Improves wave-form impulses transmitted over conductors having high electrostatic capacity.

1,445,235. IMPULSE TRANSMITTING DEVICE; L. D. Plotner, Brooklyn, N. Y. App. filed April 14, 1920. For use at an operator's position in semi-automatic telephone system.

1,445,242. VARIABLE INDUCTANCE ELEMENT; W. J. Shackelton, Scotch Plains, N. J. App. filed Dec. 24, 1920. Coils wound in form such that inductance varies proportional to angle turned through.

1,445,258. TESTING SYSTEM; S. B. Williams, Jr., Brooklyn, N. Y., and H. L. Bostater, West New York, N. J. App. filed Feb. 5, 1919. Testing device for telephone apparatus.

1,445,260. METHOD OF AND APPARATUS FOR TESTING ELECTRICAL COILS; A. H. Adams, Sparkill, N. Y. App. filed Oct. 23, 1918. Detects short-circuited coil during winding operation.

1,445,278. THERMIONIC VACUUM TUBE; R. A. Heising, East Orange, N. J. App. filed Nov. 1, 1917. Series arrangement for filaments of several tubes.

1,445,324. RHEOSTAT; A. A. Kent, Ardmore, Pa. App. filed July 24, 1922. For varying filament current in vacuum tubes.

1,445,360. ELECTRIC TROLLEY APPARATUS; E. Schild, Seattle, Wash. App. filed Dec. 31, 1921. Trackless trolley pole.

1,445,391. SLIDING-TROLLEY SHOE; H. B. Coats, Veedersburg, Ind. App. filed Feb. 24, 1922. Reversible flat surface.

1,445,398. INCANDESCENT ELECTRIC LAMP; K. Kambayashi, Kuze-Gun, Kyoto, Japan. App. filed April 29, 1921. Protects filament and lead wires from injurious effect of Edison effect current.

1,445,411. PROCESS OF MAKING VALVES; C. Pfanstiehl, Highland Park, Ill. App. filed Dec. 26, 1916. Welding two pieces of metal of different melting points.

1,445,421. TELAUTOGRAPHIC SYSTEM; G. S. Tiffany, Summit, N. J. App. filed July 25, 1916. Telautographic and telephonic messages simultaneously transmitted over the same line.

1,445,422. VARIABLE INDUCTANCE; E. T. Turney, Holmes N. Y. App. filed March 22, 1921. Hinged coils.

1,445,432. TELEPHONE-EXCHANGE SYSTEM; B. G. Dunham, Hawthorne, N. J. App. filed Aug. 7, 1919. Decreases time interval between actual seizure of trunk and application of busy connection.

1,445,501. HOT-WATER BAG; H. F. Dwinall, Highland Mills, N. Y. App. filed July 15, 1921. Electrically heated.

1,445,503. GALVANIC BATTERY; G. Filler, L. Fuller and G. J. A. Fuller, London, England. App. filed Feb. 16, 1921. All action prevented until it is required for use.

1,445,529. ELECTRIC LOCK AND ALARM FOR AUTOMOBILES; S. L. Mathews, St. Louis, Mo. App. filed Oct. 11, 1919. Mechanically controlled automatic clutch and electrical locking and circuit-making-and-breaking mechanism.

1,445,567. BATTERY-CHARGING CONNECTOR; M. D. Sweet, Alliance, Ohio. App. filed May 26, 1921.

1,445,580. AUTOMATIC SYSTEM OF CONTROLLING THE CHARGING OF STORAGE BATTERIES; O. P. Fritchle, Denver, Col. App. filed March 1, 1920. Gives a direct indication of the amount of charge that is in battery.

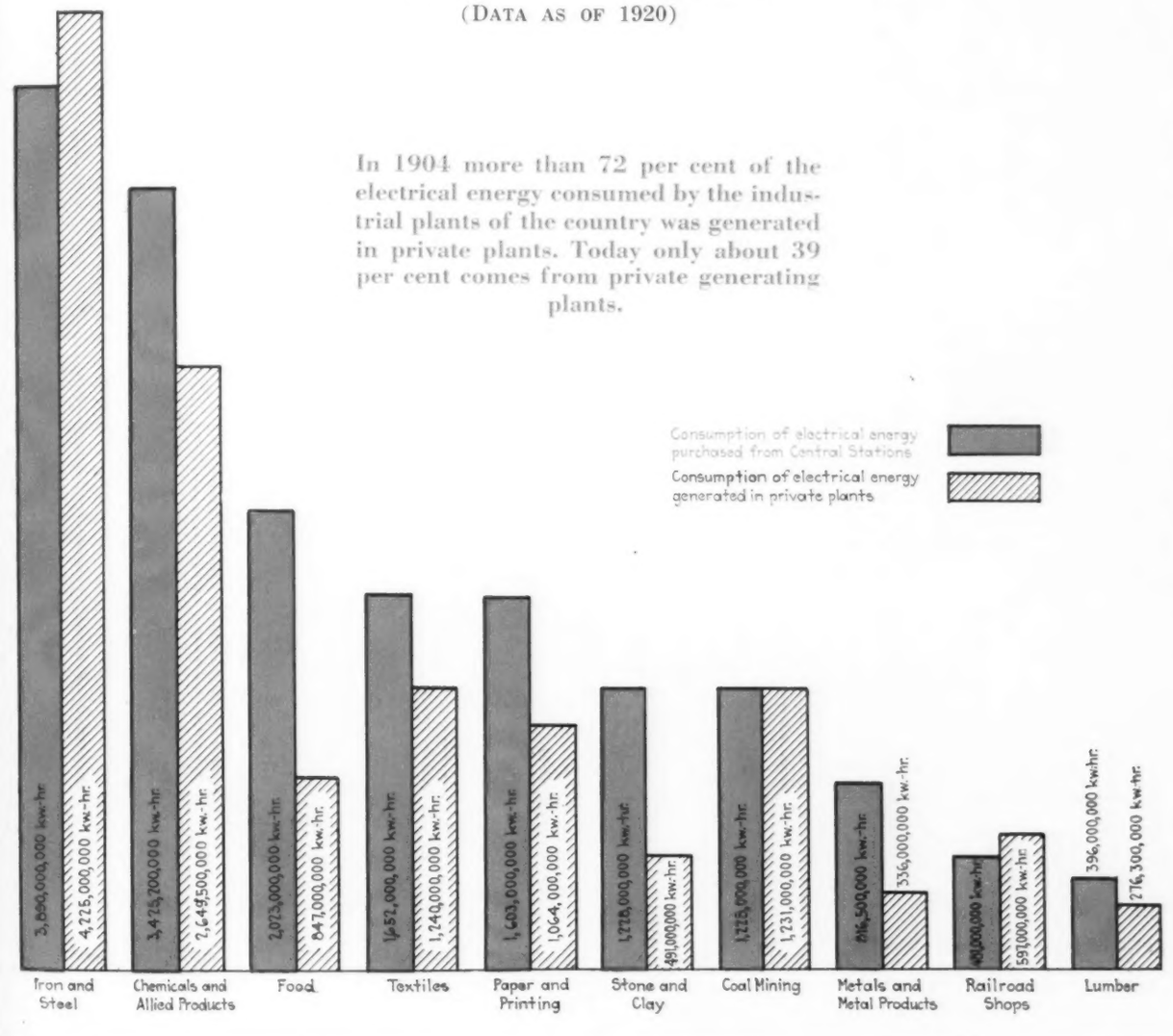
1,445,585. STREET INDICATOR; W. Guier, Wichita, Kan. App. filed Jan. 8, 1921. Indicates next stop of vehicle.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

The Extent to Which the Central Station Has Supplanted the Private Generating Plant

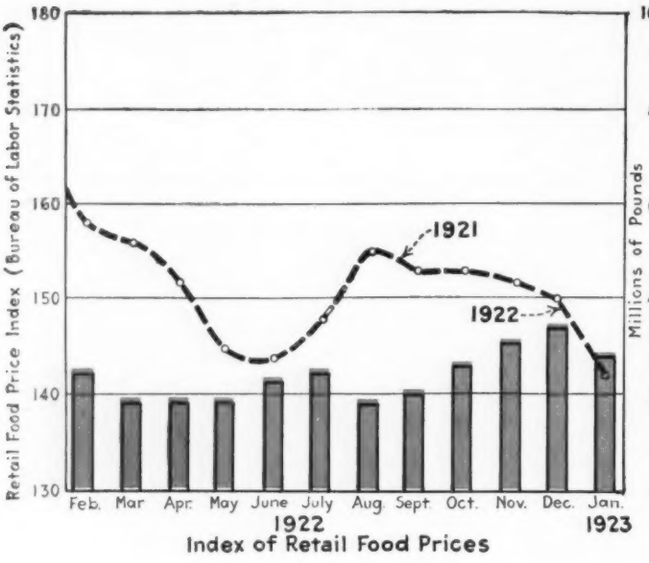
(DATA AS OF 1920)



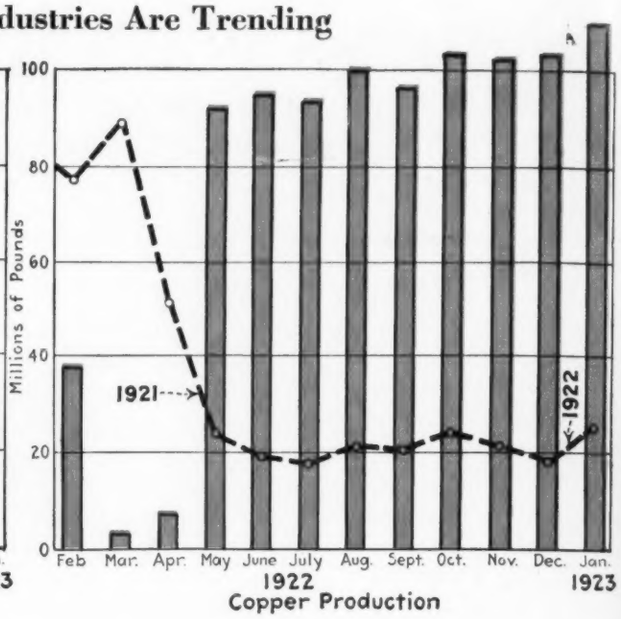
A Measure of Progress

"ACHIEVEMENT is the measure of progress, the prophecy of greater things." The electric light and power industry during its forty years of history has achieved results unparalleled by any other primary industry and stands today on the threshold of still greater things. The gradual replacement of privately generated power by central-station service brought about by the greater efficiency, lower costs and greater dependability is of itself an achievement worthy of record. In 1904 more than 72 per cent of the electrical energy consumed by the industrial plants of the country was generated in private plants. In 1920 all but three primary industries used more central-station energy than electrical energy from private generating plants, and it is probable that today the central station has overtaken private-plant generation even in these three industries. The progress of the industry is continual.

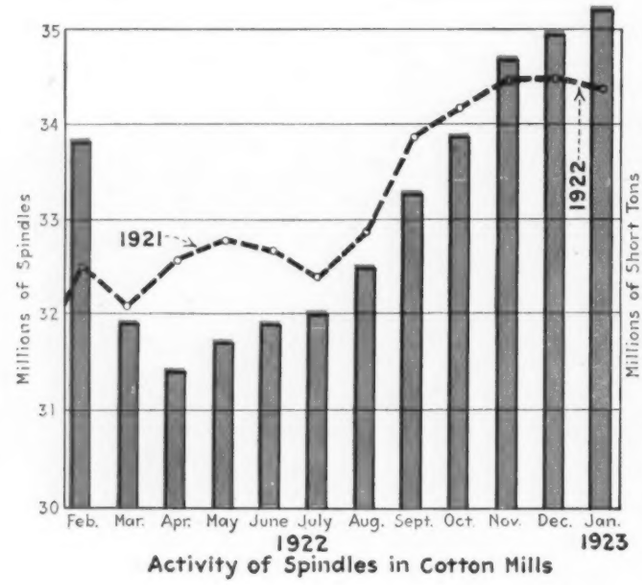
How the Primary Industries Are Trending



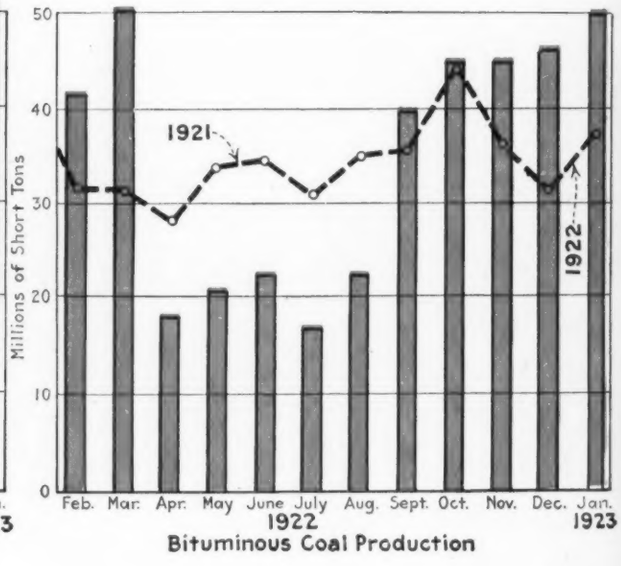
Index of Retail Food Prices



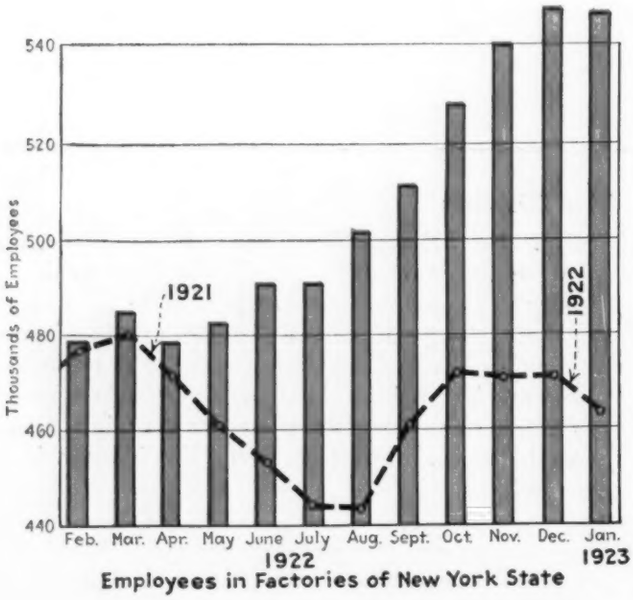
Copper Production



Activity of Spindles in Cotton Mills



Bituminous Coal Production



Employees in Factories of New York State

Factory Employment Retarded

ALTHOUGH a large increase in general productive activity is indicated by figures received from the Department of Commerce for January, data on employment in factories for the typical industrial state of New York indicate that the high point of employment has been reached, at least temporarily. The number employed during January, however, was still approximately ninety thousand below the high figures reported in March, 1920, so that the slight drop reported for January is probably only a seasonal reaction, which will be overcome as the year advances. The almost uniformly large monthly increases in number of factory employees which have been experienced since last July were bound to taper off as industry caught up with demand, and it is probable that from now on employment will show the ups and downs which are normally characteristic of the various seasons of the year.